Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, OCTOBER 9, 1915 No. 15

Rewards of Taking Civic Responsibility

WITH the approach of Electrical Prosperity Week managers of central stations in towns and small cities realize as never before the influence and power that comes with a record for civic service. The central-station manager or the leading electrical contractor in the city or town who has identified himself with the board of trade and worked as a fellow member, shoulder to shoulder with the other representative merchants and business men, is in a position to claim support from his entire city. The man who has been a stay-at-home cannot. Of course, he has an enterprise in the Prosperity Week celebration that will make a strong appeal to non-electrical interests as a purely business proposition, but beyond that there is a much wider opportunity. Within the last few years it is gratifying to find so many managers participating in the life of their communities and assuming the responsibilities of public office and the opportunities for service that come with it. In several cities electrical men are to be found at the head of the chamber of commerce or in the forefront of committee work, and by this activity each one of them has earned a popularity that is an invaluable asset not only for himself but for his company and his personal business future. Consider the degree of sympathy which these men can command for the widening of the application of electricity and what it will be worth to their communities. Electricity as represented by them, in the local point of view, has become a friend to all the town and as a friend will prosper.

The Chance for the Motor Vehicle

AN electric motor is not simply a substitute for a horse between the shafts of a truck. The motor-driven vehicle does more than replace the horse-driven vehicle. The installation of a motor-driven vehicle sets a faster pace for the complete delivery or haulage system and enables new and better standards of performance to be maintained for the general methods of handling and transporting products. Our delivery systems have been built up around the horse as a motive power. The horse has physical limitations of endurance. Observations show that the horse stands six and one-quarter hours out of every ten. As a consequence, loading and unloading operations and the flow of products in and out of merchandise-handling establishments have all been planned with the physical capacities of the horse as the prime consideration. The motor truck has no such physical limitations. It can work and must work almost continuously to be most economical. Specific information as well as interesting generalizations on this important relation between horse, electric and gasoline trucks are presented in the final report of the electrical engineering department of the Massachusetts Institute of Technology, published under an appropriation by the Edison Electric Illuminating Company of Boston. Motor trucks to be most successfully operated must be the nucleus of a delivery plan which may differ materially from the delivery system for which the horse is the motive power. An electric motor truck puts the delivery of products on an engineering and not on a rule-of-thumb basis. Manufacturers, therefore, in general must sell not only the electric vehicle itself but a plan for using it successfully. They must offer the user the modern substitute for an old-fashioned method of packing, receiving, storing, handling, shipping and discharging merchandise which has been developed with the horse as the motive power. The wider distribution of any special product which knocks the props from under the traditional way of doing work generally depends on accompanying that product with a plan showing how the better way is brought about. The price of the product legitimately must include the cost of showing buyers how they can improve their methods.

The 50,000-Kw. Steam Turbine in Sight

BULK demands for energy on metropolitan stations are creating designs of equipment and operating practice that point to a marked advance in steam-station engineering. The operating experiences with turbo-generators of 20,000-kw. rating and over in several of our large cities seem to indicate that a water rate of 12 lb. per kilowatt-hour at full rated load is an average performance, while at least one installation of a 30,000-kw. unit during recent tests has shown a water rate as low as 11.3 lb. per kilowatt-hour. In general, the economy of the larger machines now in operation and going into operation seems to be from 10 to 20 per cent better than for units built not more than three years ago, making a possible saving in operating costs that amounts in some cases to at least 20 per cent. Two types of large turbines are now competing for first place in operating efficiency, namely, the design with a single runner and a single generator and the design which carries out the steam expansion in two elements operating at different speeds with each element driving its own generator. The latter design is the one used by the Interborough Rapid Transit Company of New York City. A unit of the former type having a rating of 35,000 kw. is soon to be started in the new station of the Philadelphia Electric Company, as mentioned elsewhere in this issue of the ELECTRICAL WORLD. While

this unit is the largest one built up to this time, there is now on the horizon a unit of 50,000-kw. rating concerning which engineers are expressing considerable confidence as a further solution of the problems brought about by the growing demands for energy and higher operating efficiencies. In connection with the operation of such large units new developments in station design are suggested. Higher steam pressures seem certain, and it is probable that even 500 lb. or 600 lb. per square inch will be considered a practical pressure in many cases, while a pressure of 1000 lb. has been suggested for units of 30,000-kw. to 50,000-kw. rating. This will virtually mean a revolution in the design of steam piping and fittings and involve a thorough study of the relation of auxiliaries to the turbine pressure and the limitations of pressure available for use with condensers and other equipment. Unless there is an increase in steam pressure or superheat, marked gains in water rates cannot be expected in going to the higher ratings. With an operating steam pressure of 500 lb. per square inch or thereabouts, it is reasonable to expect a gain in efficiency of around 10 per cent, which will certainly be an interesting performance in view of the results now secured under ordinary steam conditions. A further and an interesting possible saving with the larger units is that due to labor. It is not probable that a larger or a more skilled force of men will be required to operate a 50,000-kw. unit than is now called for by the 30,000-kw. turbine, so that the cost of labor per kilowatt-hour generated will be appreciably reduced. With few mechanical difficulties in the way of building and operating these monster turbo-generators, and with the demands for energy in bulk certain to increase more rapidly in the future than in the past, not only is the early arrival of the 50,000-kw. unit probable, but even one of larger rating may make its advent.

Test Installation of Bare Concentric Wire

Bare concentric conductors for interior wiring will have their place in future applications of electricity. Many problems are involved in the general application of this form of wiring; but only the fullest discussion of the advantages and disadvantages of this system will give it its place in the industry. It is therefore worth while summarizing the results of the first installations of concentric wiring in America, described on other pages of this issue. Great credit is due the local central-station company, the manufacturers, the contractors, the insurance company and the N. E. L. A. committee on wiring for their co-operative and successful effort. Practical tests help settle many misconceptions and clear the way through much discussion. The trial installations were completed with American-made products exclusively except for the "twist-ons," which were not available. Naturally, in these trial installations it was not possible to procure standard types of fittings for concentric work. It is to be hoped that within the next year or two different manufacturers will add such lines to the fittings already available for regular work and which will continue to be needed. Such a line of material will not seriously interfere with existing types; on the contrary, it will permit the manufacturer and contractor to get new business where apparently there was none before. While no figures of cost are available at this time, there was a substantial gain in efficiency in wiring the second and third residences, so that the final house was wired at a cost closely comparable with the present house-wiring campaign prices of the Boston Edison company. The trial installation indicates that with fittings and appliances especially designed for the work a field for wiring homes and small mercantile establishments will be opened which could not use present standard equipment. Appearance, also, has come in for its share of discussion, which the trial helps to settle. By painting the sheath to match wallpaper and interior woodwork the appearance of the test installation is by no means unattractive. All in all, these trial installations have shown what can be done in a most admirable manner. The possibilities are evident, as has been pointed out in the earlier presentation of this subject in the ELECTRICAL WORLD. It will be surprising if this practical working out of the bare concentric-wiring system in Boston does not open a fruitful field for popularizing electric service in communities, such as those which surround industrial establishments, where kerosene and gasoline are competitors of electric light.

Long-Distance Radiotelephony

It has become a habit to accept the marvelous as commonplace. Since the Philadelphia Centennial, only thirty-nine years ago, so many prophecies of fiction have become scientific fact that new announcements are quickly taken for granted. Radiotelephony from New York to Hawaii has become fact. Yet the wonder of the achievement is nearly lost sight of. We accept the fact and immediately discuss how soon a way will be found to transmit visual images as well as sound electrically. The announcement of the transmission of telephone messages over long distances without wires follows, moreover, only a few months after the establishment of wire communication between New York and San Francisco. While the exact detail methods by which both these achievements have been made possible cannot be made public at this time, that long-sought device, the telephone relay of great delicacy and practically zero inertia, is considered to be the element which, in combination with modern forms of almost distortionless line construction, has made possible the transcontinental telephone.

It is both interesting and significant to learn that this same device is the single new instrument which has, in the past few months, extended the attainable signaling range of radiotelephony from some few hundreds to nearly 5000 miles. The development of these devices has been going forward for some time. The several steps have been taken, as a rule, hand in hand with those in the closely analogous art of radiotelegraphy; in fact, the advances have in general been

made for telegraphic use and thereafter applied to the radiotelephone. In this way the sensitiveness and selectivity of receivers have been improved, the design of radiating and absorbing aerial structures has been bettered, and plants for the generation of large amounts of sustained-wave energy have been produced. All of these are equally applicable to both radiotelegraphy and radiotelephony. Telephony without wires has been unable to progress much beyond its early stages, however, through the lack of apparatus for modulating powerful high-frequency currents according to variations of the voice. The commercial carbon microphones handle at most a few watts, whereas for radio hundreds of watts should be controlled. The discovery and development of the vacuum-tube repeater has now provided the needed instrument; in this instance radiotelephony has fallen heir to that which was created for wire telephony. The type of relay which amplifies the effect of an ordinary transmitter connected by wire with the sending radio station may, in much the same manner, be used to build up the strength of the received signal. Thus voice variations which are inaudibly weak in the usual wireless receivers may be magnified so that they are loud enough to be heard easily by a receiving operator, and, in the absence of disturbing noises from interference or "static," tremendous distances may be covered by radio.

The greatest remaining problem in radiotelephony is that of overcoming atmospheric interference. This handicap also exists for the radiotelegraph, and until its solution is reached or approximated it will be impossible to make continuous commercial use of these most delicate receivers for radio communication, either by Morse or by voice. The accomplishment of the men working under Chief Engineer Carty of the American Telephone & Telegraph Company in carrying to a successful demonstration the development and application of amplifiers in radiotelephony is, nevertheless, a work deserving the fullest appreciation. Distortion-free, non-depreciating trunk "lines" are a great stride nearer to realization than was generally believed a few months ago.

Tower-Line Protection Against Sleet Havoc

With the approach of the season during which sleet and snow storms work their greatest havoc to transmission lines it will be found profitable from the standpoint of preparedness to consider the lessons of last year's experience. Of particular interest is one storm of the past spring that raided the South Atlantic Coast of the United States, becoming most ferocious in a section of North Carolina, where a whole hydroelectric system was seriously disabled. Unusual atmospheric conditions with snow, followed by rain at freezing temperature and by a strong gale, loaded the line wires to a point which at the time of the design of the line had been considered entirely unlikely for that section, covering the conductors with snow, in semi-ice condition, to a diameter of six inches. From an engineering standpoint the interesting feature of the damage to the transmission lines was that it fell upon wooden-pole lines and steel-tower lines alike, putting them out of commission with an even hand. The wooden lines failed in the usual manner, but the tower lines appear to have given away chiefly by twisting and buckling from the sheer weight and drag of the loaded wires. The wind in itself was really not heavy; in fact, hard winds rarely coincide with conditions which permit the formation of sleet.

The modern tower line, with its very widely separated wires and long overhang of the insulator supports beyond the tower head, seems to be particularly liable to twisting from the mere length of the lever arms, and this, from the reports which have reached us, seems to have been the chief cause of failure. A twisting tower is quite likely to buckle under the combination of torque and weight, and it appears to have been satisfactorily demonstrated in this storm that the tower line, like any other overhead line, is subject to considerable risks from the combination of sleet and wind pressure. It is somewhat difficult to say what the moral of the tale may be. It is entirely evident that the resisting strength was inadequate. It is not at all clear, however, just what the remedy should be. Perhaps the tendency in building tower lines has been to employ too long a span for too light rigid construction. It is not impossible that a more flexible tower system, depending for security not on the rigidity of each and every separate structure but on extremely secure anchoring at intervals of a few towers and considerable flexibility between these limits, would have resulted in less damage. The other alternative for safety would seem to be much greater conservatism in spacing and factors of safety on the one hand or the actual consideration of underground circuits on the other. Underground operation over long distances represents a serious task not to be undertaken without extreme need. Underground work at high voltage and fifty cycles has become fairly common on the Continent, but the ordinary distance of transmission there is so much less than here that parallels cannot be safely drawn.

It would seem desirable in any event to take greater precautions in the construction of important main lines such as may be damaged by heavy storms. If at every mile or so the supporting structure was built in the form of a bridge, thus freeing the supports from heavy torque, well anchored against pull in the direction of the line, considerable flexibility could be allowed in the intermediate supports and the attachment of the wires to them. In designing a line one must either make it strong enough to support any conceivable strain at every point or deliberately provide flexibility except where the strains are intentionally concentrated and taken care of. In any event the failure of service from severe storms points to the great desirability of separating large circuits as far as may be, and reaching all important load points by way of an interconnected network so that nothing short of a very complete destruction of the lines can interfere with a prompt resumption of interrupted service.

Opening of the New York Electrical Show

The Electrical Exposition and Motor Show, the ninth given in New York City under the patronage of the central-station companies of Greater New York and of New Jersey, opened at the Grand Central Palace on Wednesday of this week. E. W. Rice, Jr., president of the General Electric Company, had charge of the preliminary functions incident to the formal opening, and J. W. Lieb of the New York Edison Company outlined the objects of the show and the aspirations of the central stations of the city regarding electric service. Telephonic connection was made between the Panama-Pacific International Exposition at San Francisco and the Grand Central Palace, and C. W. Moore, president of the Exposition, and Arthur Williams, president of the Show, exchanged greetings. As in other years, almost every electrical device suitable for the home is shown in operation. The Palace itself is a blaze of light, and the avenue leading to it is also specially lighted for a number of blocks. All of the metropolitan central-station companies have booths, the space occupied by the larger companies being especially conspicuous and appropriately decorated. The Show will close on Oct. 16.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

VOICE CARRIED 4900 MILES BY RADIO

Wireless Telephonic Communication from Washington, D. C., to Honolulu—Events Leading Up to Present Remarkable Tests Outlined, with Comments by Leading Wireless Experts

The human voice was successfully carried across the continent by wireless telephony on Sept. 29, when Theodore N. Vail, president of the American Telephone & Telegraph Company, in New York, spoke to J. J. Carty, chief engineer of the company, in Mare Island, San Francisco Bay. Speech transmitted from the radio station at Arlington was also heard clearly at the Pearl Harbor station in Hawaii, 4900 miles away.

With a few notable exceptions, radiotelephone workers of the past have been so much given to claiming great things for their various instruments and then failing to accomplish anything even remotely resembling the original promises that it is gratifying to find a real accomplishment in the art not previously advertised. Fessenden's demonstrations were made without ostentation; the radio transmission of speech from Brant Rock to Plymouth, although covering a distance of only 12 miles, in which the high-frequency current of 70,000 cycles was produced by a special alternating-current dynamo directly connected to the aerial wires and was modulated by voice waves received over a line wire and acting through a new type of microphonic relay, came as a surprise to the world. This work was extended gradually, until at a distance of about 400 miles the power-handling limit of the carbon modulators was reached. In spite of many inventors' announcements of transatlantic telephony about to be established by wireless, the early work has remained a complete record (except for a few sporadic communications established under extremely favorable conditions) until recently.

Practical radiotelephony over long distances has awaited the development of instruments suitable for modulating large powers, in much the same way as transcontinental wire telephony was delayed until suitable relays were developed. Although the American Telephone & Telegraph Company cannot now make any definite statements as to the technology of the apparatus which it has worked out for both these purposes, on account of a somewhat complicated patent situation, it is stated in radio engineering circles that the use of thermionic relays as "singing repeaters" for the generation of high-frequency oscillations, similar devices for modulating the large radio-frequency power thus produced, and additional amplifiers for magnifying the response at the receiving station, have made possible the recent long-distance telephonic transmissions.

The work of the American Telephone & Telegraph Company on these lines has continued for some little time past. Early this year an experimental station having an antenna of six 600-ft. wires strung between steel towers 160 ft. in height was erected at Montauk Point, L. I. Wireless telephonic speech transmitted from this plant was received at New York and then at a receiving station at Wilmington, Del., 200 miles away, loaned for the tests. Soon thereafter an experimental receiving station having an antenna some 1000 ft. long on 120-ft. masts was erected on St. Simon's island, about 1000 miles from Montauk Point. Radiotelephonic speech was received here and relayed back over the wire lines to New York City. As Bancroft Gherardi of the company puts it: "The results of these earlier tests so conclusively demonstrated the correctness of our theories and the value of our work and its possibilities that steps were immediately taken to try distances comparable with those involved in transatlantic and transpacific telephony."

It had been known for some time that the American Telephone & Telegraph Company and the Western Elec-

tric Company had been experimenting in radio-transmission from the Arlington station of the United States Navy Department, the aerial of which was loaned for that purpose. That the results which would be secured were to be of such great importance and interest was hardly suspected, however. After a period of preliminary experimentation, in which the special apparatus of the telephone company was connected to the aerial supported from the three tall towers at Arlington, on Aug. 27 a telephonic test was made from there to Darien, Isthmus of Panama, 2100 miles away. Satisfactory speech was actually transmitted between the naval stations at these points, and greater likelihood of success for the anticipated transcontinental tests was thus indicated.

On Wednesday, Sept. 29, shortly after noon, everything was ready for talking by radio from Arlington to the California coast. Receivers were adjusted at the naval stations at Mare Island and San Diego, 2500 and 2300 miles distant respectively from Arlington. Wire connection with New York was made from Arlington, and the relays there were arranged so that speech from the company's New York offices could be impressed upon the wireless radiation. Thereupon President Theodore N. Vail in New York spoke to Chief Engineer John J. Carty at Mare Island, his voice being carried by wire to Arlington and from there across the continent by wireless. The wave-length used was about 6000 meters, and the sending antenna current was in the neighborhood of 100 amp.

"Speech Possible with Japan"—J. J. Carty

In commenting on the success of the experiment, Mr. Carty said: "What pleases me is that the standard office telephone instruments were sufficient for sending and receiving. A most interesting part of the achievement is the automatic transmission of messages from wires to wireless and back again to wires. The transcontinental experiment might have been conducted from a San Francisco office building, but we wanted to be near the apparatus at Mare Island. It is only a matter of time until it will be possible to telephone by wireless from the United States to Japan. Conversation with European capitals will be perfectly possible, and but for the war we should have tried to talk across the Atlantic in this first experiment.

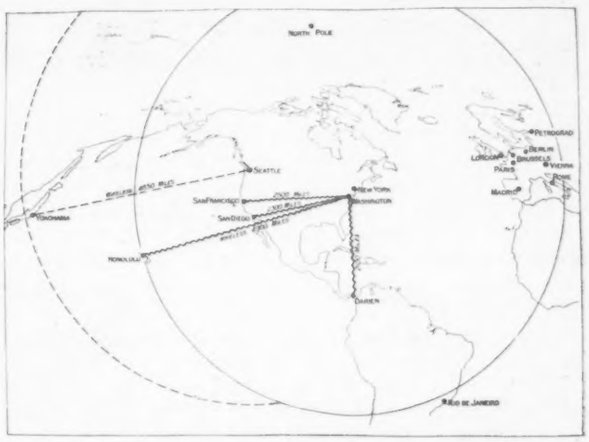
"Overcoming atmospheric disturbances is the greatest problem we have. During the conversation with New York there was sometimes a roar like the sound of distant musketry, which was recognized as static disturbance, the source of far greater trouble to the wireless telephone than to the telegraph. Owing to the large number of vibrations required for transmitting a telephone message, tuning for wireless telephony permits of a very much smaller number of separate conversations than in telegraphy. This is but one of the reasons that have developed which show clearly that the function of the wireless telephone is primarily to reach inaccessible places where wires cannot be strung. It will act mainly as an extension of the wire system and a feeder to it."

Honolulu Hears Arlington

A number of other officers of the company, both at New York and Arlington, used the transcontinental radiotelephone during the remainder of the same day. Reports on the speech as heard at Mare Island and San Diego were received from time to time by wire telephone and telegraph. Word also came from Darien, Panama, that the speech was being heard there. But the climax was reached when, soon after midnight, receipt of the transmitted voice waves was reported from Pearl Harbor, near Honolulu, Hawaii, about 4900 miles from Arlington. As would be expected, the signals at that great distance were not so strong or easily handled as at San Francisco, but nevertheless a number of different observers were able to receive words and connected sentences distinctly.

When not subject to static interference the articulation was good and the volume so great that the received words could be heard with the telephone receiver some distance from the ear. At many times, however, static interference was bad and prevented the reception of intelligible speech, and at times there was serious interference from nearby high-powered wireless-telegraph stations, according to Mr. Gherardi. All this is especially interesting when considered in the light of the small antenna used at Pearl Harbor. Here the American Telephone & Telegraph Company erected a temporary structure consisting of a span about 250 ft. long running from the top of a smokestack about 100 ft. high to the top of a water tank about 80 ft. high. The connection to the receiver was made by a lead from the smokestack end, at right angles to the main aerial, to a pole 30 ft. high and 400 ft. away.

Considering the tests as a whole, it appears that some



MAP SHOWING 4900-MILE RADIUS OF ARLINGTON-HONOLULU EXPERIMENT

degree of transatlantic telephony is assured. The antennas used were not exceptionally large in any case, except possibly that of the receiving plant at Darien, and with structures of modern design it seems not too much to anticipate the possibility of telephony across the Pacific from Seattle to Yokohama. The map which is reproduced herewith sets out in striking manner the several great spans actually covered.

Wireless to Be Adjunct to Wire System, Declares Gherardi

Under favorable conditions even the transmission of speech from the Pacific Coast to New York and thence by radio to London, through the relaying system, seems within the bounds of possibility. This feature of interconnection, at both sender and receiver, between the wireless and the wire telephones is one of the most satisfying results of the new developments. The possibility of relaying messages in this way opens up a great new field for the radiotelephone, and therefore, Mr. Gherardi says, he expects it to form a new and important adjunct to the wire system of communication. By means of wireless there can be established communication between points to which it is impossible to extend wires. Nevertheless, both he and Mr. Carty point out, for many reasons radiotelephony can never take the place of wire systems. Wireless communication, both telephonic and telegraphic, is from its nature subject to interference and disturbance from numerous natural and artificial conditions. The great problems of eliminating static or atmospheric interference and station

interference and of providing secrecy have still to be solved commercially.

It is said by Mr. Vail: "So far as the perfection of the wireless telephone goes, there has been no new basic invention, merely a perfection of the sending and receiving instruments. Of course, in the perfection of these delicate machines there have been minor inventions." So rapid and phenomenal has been the growth of radio investigation that many men of unusual scientific ability have been attracted to its fields. The comments of these men are particularly interesting.

Marconi Believes London-New York Service Assured

William Marconi, the pioneer in commercial wireless telegraphy, is quoted in a London special as saying: "There is not a shade of doubt that wireless telephony across the ocean is assured in the future. The time will come after the war when a man may take up a receiver in his London office, ask central to connect him with New York, and do his talking without any more effort than if he were in conversation over the wire with Paris. An ordinary receiver such as is now used could be employed at each end."

Audion Principle Outlined by De Forest

Dr. Lee de Forest said to a representative of the ELECTRICAL WORLD:

"In 1907 I secured a patent on the audion as an amplifier of pulsating or alternating current. There appeared to be no lower limit of sensitiveness of the audion amplifier, and unless overloaded there was no observable distortion in the amplified current. By use of two or three audion amplifiers in connection with very faint telephone currents an amplification of 100 to 1000 times is obtainable. As an amplifier of telephonic current the audion has certainly proved its value in the long-distance telephone lines of the American Telephone & Telegraph Company. This company is licensed under all the issued audion patents, both for wire and wireless telephony, and has made remarkable advance in both these departments by use of the audion principles.

"It is, however, as a source of high-frequency electrical oscillations suitable for radio communications that the audion-type bulb is just now arousing the greatest interest. From one audion oscillion bulb, 3 in. in diameter, I am able to generate 25 watts of high-frequency energy, capable of telephoning 3250 miles. I built these bulbs up to 7 in. and can get very much larger power out of larger sizes. Dr. Langmuir of the General Electric Company, I understand, has succeeded in getting as high as 1 kw. in a single bulb by using a very high voltage and exhausting the lamp to the highest degree possible.

"By connecting the bulbs in parallel greater power is obtainable. The Western Electric Company's engineers have been quick to recognize the possibility of this multiple-unit service, for in the Arlington installation they have employed some 300 audion oscillion bulbs in multiple, from each of which they obtained about 0.5 amp. of high-frequency current. The use of the audion principle in transmission and for amplification and detection has made transcontinental telephony possible."

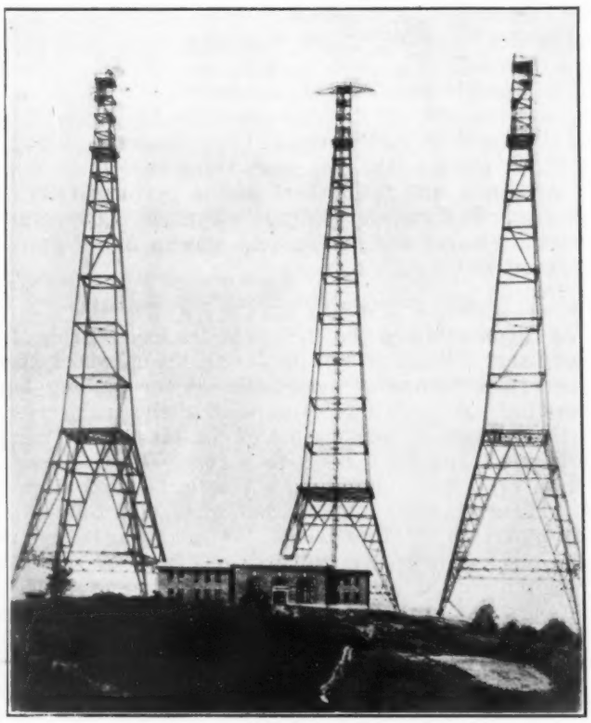
Pupin Points Out Effects Due to Static Forces

Prof. M. I. Pupin, whose invention of the "loading coil" made long-distance wire telephony possible, said to a representative of the ELECTRICAL WORLD:

"The greatest problem of all wireless work, and particularly wireless telephony, is the elimination of the effects of static disturbances. Every grounded system is acted upon by these forces. The Delaney system of wire telegraphy was a failure because of static influences. The Wheatstone system was successful because it had solved this problem.

"In wireless work, however, the effect is much more pronounced because of the vertical system. In fact, so serious are these static effects that stations on the Atlantic Coast have frequently had to suspend operations for forty-eight hours at a time. These disturbances are, however, not always so serious; at times there comes a lull or calm. It is at these times that we hear of record-breaking achievements in long-distance wireless telegraphy.

"The solution of the problem of overcoming static influences does not lie in increasing the sending power. This has been repeatedly tried only to fail. Owing to the necessity of secrecy at the present time because of pending patents, I am not at liberty to say just what the solution is: I will say this, however: I have solved this problem. Theory, experimental results obtained in my laboratory and actual antenna results all agree exactly. There is absolutely no question regarding the



THE ARLINGTON STATION FROM WHICH THE VOICE IMPULSES WERE SENT

successful operation of my discovery. It works both practically and theoretically."

In an interview with a representative of the ELECTRICAL WORLD, Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, said:

"The recent demonstration by the American Telephone & Telegraph Company has drawn forth discussion as to the arrangement and character of apparatus employed, and the claimants for complimentary mention and for priority of invention are cropping up in many directions. The success of this experiment was largely due to the employment of an improved form of vacuum valve. Of course, the work of Dr. Lodge and of Marconi in tuning the circuits is indispensable and of primary importance in wireless telephony as well as in wireless telegraphy. Professor Fleming of the College of the City of London has pointed out that a vacuum chamber containing a hot element and a cold element is well adapted to receive and respond to these extremely minute oscillations of current. He also pointed out that the vacuum valve was a rectifier of these oscillations

and that it was well adapted for a detector in wireless signaling.

"Undoubtedly Professor Fleming's invention is the keystone of the arch on which this successful demonstration is supported. The Fleming vacuum valve has been used by the American Telephone & Telegraph Company in its land-line work and was very extensively employed as a repeater in the demonstration made on land lines between New York and San Francisco some time prior to the wireless demonstration above referred to. It is well known that that land-line demonstration was founded on the invention of Professor Pupin, who contributed the 'loading coil.' It also involved the use of a composite circuit and much experience gained by experimental work. Without the vacuum valve of Fleming it would be impossible to telephone any such distance as indicated. Dr. Langmuir of the General Electric Company greatly improved the Fleming valve, and Roy A. Weagant, chief engineer of the Marconi company, has, while working in the laboratory of that company, obtained much information and valuable data and has invented improvements which go far toward rendering the valve more practical, more constant and more useful as a commercial apparatus."

A. E. R. A. AT SAN FRANCISCO

Electric-Railway Men Discuss Problems of Public Relations and Business Conditions Confronting Their Industry

The convention of the American Electric Railway Association and its allied and affiliated bodies, which met in the Native Sons' Building at San Francisco, Oct. 4 to 8, was characterized by a spirit of enthusiasm and energy and by a number of important addresses on leading topics of the day by men of national reputation. Notable among the papers were those on "Evils of Government Ownership" by ex-Senator Bourne, "The Foundation Principles of the Valuation of Electric Railways" by B. J. Arnold, "Welfare Work" by J. W. Lilienthal, and "The Relation of Electric Railways to Agriculture" by Paul Shoup.

President C. Loomis Allen in his address gave a vivid picture of the problems now confronting the electric-railway industry. He pointed out that business depression has wrought such havoc in earnings that the value of securities has been seriously affected and the market for new securities with private investors almost completely destroyed. Furthermore, municipal ownership, partnerships with municipalities, State regulation and home rule have from time to time been sources of great concern to owners and operators of electric railways. The speaker pointed out that if there is to be successful railway operation all parties interested in railway operation—meaning the public, employee, State and municipality, and investor—must be reasonable in their demands. In addition, it was pointed out that quality of service is dependent wholly upon the securing of capital to provide the facilities for rendering such service. Therefore the public and regulating bodies should not make it difficult to secure necessary capital.

In referring to the past year's work of the association, the president mentioned the participation of the association's representatives in the conference called by the United States Bureau of Standards to consider its proposed safety rules. By means of inquiries addressed to its member companies the association is collecting a considerable quantity of valuable data for the use of these representatives. It is anticipated that their co-operation will have an important influence upon the character of rules to be finally promulgated by the Bureau of Standards.

In closing his address, the president made the following recommendations: That members of the legal departments of member companies be brought in closer touch with the association's work, and that the now allied manufacturers' association be granted a charter, placing it on the same basis as the engineering, accountants', transportation and traffic, and claims associations.

The engineering association's committee on power generation presented a report outlining a method for analyzing power-station costs that was decidedly novel. This affiliated association has also contributed liberally to this year's progress by a report on power distribution, including specifications on overhead-line materials.

One of the most important addresses before the accountants' association was that by G. B. Willcutt, emphasizing the important part that accountants' reports play in administrative work when they are properly compiled, compared and analyzed.

Friday morning was Exposition Day at the convention, and a bronze plaque was presented to the association by the officers of the Panama-Pacific Exposition Company, commemorative of the 1915 meeting. Among those who spoke at this assembly was James H. McGraw of the McGraw Publishing Company, who referred to the important influence exercised on the industry by the American Electric Railway Association and allied manufacturers' association. He pointed out that the electric-railway industry has kept pace with the best in American industrial life and has gone hand in hand with other important developments that have made this country the leader of the world in prosperity and those things that make for the convenience and comfort of its people. During a short period of thirty-five years a tremendous industry has been created, now capitalized at more than $4,500,000,000, exclusive of the large amount of capital invested in the immense industries required to supply these railway companies with apparatus in the way of cars, electrical equipment, generating apparatus and rails. The number of passengers carried increased from 2,023,010,290 in 1890 to more than 12,000,000,000 in 1912. More important than these figures, however, is the effect which electric railways have had on the comfort, health and prosperity of citizens.

Jovian Convention Arrangements

Arrangements have been completed and all preparations made for the thirteenth annual Jovian convention, to be held at the Hotel Sherman, Chicago, Ill., Oct. 13, 14 and 15. Many prominent men both within and without the industry have signified their intention of being present at the convention and of delivering addresses.

Papers will be presented on the following topics: "Extending the Utilization of Electrical Energy," "A Clearing House for Electrical Associations," "The Relation of the Jobber to the Electrical Industry," "Safety in Electrical Installations," "The Relation of Technical and Non-Technical Men in the Electrical Field," "The Progress of the Electrical Industry," "Contingent Benefits from Promotion of Electric-Vehicle Sales," "The Making of a Man," "Electrical Prosperity Week," "The Public Utility as a Factor in the Development of a City," "Merchandising Methods," and "Thrift Among Employees of Electrical Companies."

Many entertainment features have been provided for those attending the convention. Arrangements have been completed whereby visiting ladies will be escorted to various points of interest by Chicago hostesses, who will also personally conduct shopping tours. Under the direction of Oscar Dane of St. Louis over 200 costumed performers, assisted by a number of orchestras, will provide the entertainment on Friday evening.

CONVENTION OF COLORADO ASSOCIATION

Organization in Convention Protests Against Ferris Bill and Federal Regulation of Water-Power

The thirteenth annual convention of the Colorado Electric Light, Power & Railway Association was called to order at Glenwood Springs by President W. F. Raber on Thursday, Sept. 23.

The attendance was the largest in the history of the association, the central stations being particularly well represented. The president in his address drew attention to the work of the association. "During the past year," he said, "the association has made an earnest effort to bring about the recognition of that fundamental principle of all public utility legislation—the elimination of competition, with complete regulation. Unfortunately, Colorado has not fully recognized this principle to the extent of writing it into her laws." The association, he said, contends for such reasonable legislation as will afford the industry protection and make it possible for it to continue to obtain the necessary capital for the expansion of business at reasonable rates of interest. This is necessary to the welfare of the business as well as to the people of Colorado if the utilities are expected to continue to develop new territory or make any considerable expenditures upon existing properties. The future of the business depends largely upon the inducements offered capital for permanent investment.

Federal Control of Water-Power

Mr. Hammond of the Colorado Power Company moved that some action should be taken at once in regard to the Ferris bill, which puts the water rights of the State in the hands of the federal government, tending to stop all future developments of use of water for power in the State. The following resolution was unanimously carried:

"Whereas the expressed policy of the federal government upon the utilization of public lands in development of water-power, as exemplified in the so-called Ferris bill, denies the sovereignty and the eminent domain of the State of Colorado and would place burdensome restrictions upon all further development of water-power; and

"Whereas we believe that the right to condemn all property, except that property devoted to federal uses upon which sovereignty is vested in the United States by its Constitution, for public or quasi-public use, whether the proprietorship of such property lies in the federal government or in private ownership, is a fundamental, constitutional right of our State; and

"Whereas, further, we believe that from an economic standpoint alone wisdom and sense would dictate that the State and not some remote authority should determine and control whatever degree of stimulation, condition or restriction, as determined by local needs and conditions, should be placed upon the development of the natural resources within the State:

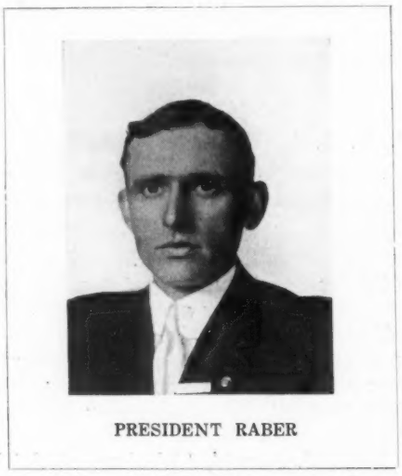
"Be it resolved, That the Colorado Light, Power & Railway Association in annual convention assembled deprecates and protests against the federal policy contained in the Ferris bill directly contravening the views herein expressed, and against any federal policy denying to the States the right to condemn public lands at not exceeding the fair market value of the lands so condemned, or any policy depriving the States of their inherent right to control and regulate their own internal affairs, or conflicting with such control and regulation by the State; and

"Be it further resolved, That this association protests against lodging in the federal government the tremendous power over all future industrial growth in public-land States now sought to be arrogated to the federal government, and declares that the policy of the federal government is most portentous to the future political welfare of the citizens of all public-land States; and

"Be it further resolved, That this resolution be spread upon the minutes of the association and copies thereof be sent to the President of the United States, the Secretary of the Interior of the United States, the Governor of Colorado, the Colorado Senators and Representatives in Congress, the president of the Investment Bankers' Association of America, the president of the American Mining Congress, the president of the National Electric Light Association, and to the proper presiding officer of the Portland conference of Western executives and legislators now in conference at Portland, Ore., upon the matter of federal policy on water-power development."

Keeping Appliances in Use

Miss Jane Aldred, demonstrator of electrical appliances for the Colorado Power Company, presented a paper on "Keeping Appliances in Use After They Are Sold." Miss Aldred described in a witty manner the appliances that are now in use and recommended that the companies selling these appliances should see that they are kept in repair. She also said that there is a great need of appliances better suited to the requirements of the housewife, that the ones now in use are inadequate in shape, in arrangement and in what they would accomplish. The inconvenience of attaching an electrical appliance was also brought out, and she hoped the unsightly cord dangling from the chandelier might be overcome, as well as the danger of stumbling over the cord attached to a wall socket. The paper brought forth an animated discussion.



PRESIDENT RABER

W. N. Casey of the Denver City Tramway Company, in his paper on "Present-Day Street-Railway Problems," treated principally of the matter of taking the public into one's confidence, remarking that the relations of the street-railway company to the public embraced a great many of its problems.

Franklin P. Wood followed with a paper on "Rate-Making to Stimulate Other Than Lighting Uses." Mr. Wood made the following statement: "Except perhaps for such special questions as power-factor, it should make little difference to us to what use the customer applies the electricity. Assuming, for instance, that one desires electricity for residence purposes, theoretically we should not inquire whether it is to be used for lighting, heating, cooking or power; rather we should ask what the demand will be, and the rate should be based on that demand, and on the cost of production and distribution."

Mr. Dostal, in discussing the paper, told of a new

meter device that is to be put upon the market which will measure the demand. That this would be a great boon was conceded by all.

The special feature of the convention was the presence of three members of the Colorado Public Utilities Commission, Messrs. Aylesworth, Rankin and Herbert. They came to discuss matters of vital importance to all central stations, and Friday's session proved one of great interest and benefit.

The "Fair Value" of Utility Properties

Mr. Rankin, engineer of the commission, gave the first paper, "Valuation of Public Utility Properties." He said that the whole theory of regulation is built upon the foundation that private ownership shall be required to furnish adequate and satisfactory service at reasonable rates and shall be allowed to earn a reasonable return upon the fair value of the property dedicated to the use of the public. There are at least four items that are to be given such consideration and weight as may be fair and right in arriving at the "fair value" of a property, namely, original or actual cost of construction, amount of bonds and stock, cost of reproduction, and probable earning capacity of property. Generally speaking, Mr. Rankin believed that the most equitable rates are those that serve the greatest number of people at the least cost and at the same time provide for a fair return to the utility.

Effective Accounting Methods

Fred W. Herbert, auditor of the Colorado Public Utilities Commission, followed with a paper on "A Uniform System of Accounting." Mr. Herbert said that any system of accounting must be simple but accurate and effective and designed to show satisfactorily a complete analysis of the investment, the earning and operating expenses, and embody enough detail to enable the commission to determine the profitableness and efficiency of the utility and to enable the utility to make its annual report to the commission in conformity with this classification.

"The Indeterminate Franchise and the Certificate of Public Convenience and Necessity" was the subject of a talk given by M. H. Aylesworth, member and attorney of the Colorado Public Utilities Commission. Mr. Aylesworth interpreted the indeterminate permit as the right to occupy and use the streets of a city or a part of the State highways, service being given for reasonable compensation under regulation by the State, and monopoly being assured to the operating company, but with the power vested in the municipality to buy the property through a vote of its people at a fair value to be fixed by the regulating body of the State. The right to do business as a natural monopoly is modified by the power of the State to issue a certificate of public convenience to a competing operating company if the service given by the company already operating is not sufficient or is not subject to proper regulation.

Some Effects of Depreciation

The next paper, "Depreciation as Affecting Valuations and Assessments," was given by Daniel W. Knowlton of Smith, Knowlton & Hatch, attorneys of Colorado Springs, Col. Mr. Knowlton presented one of the best papers of the convention, discussing his subject fully and with complete knowledge. He treated of tax assessments, "sinking-fund" and "straight-line" methods, and left no point uncovered.

A special session was held Friday evening, when B. S. Manuel, sales manager at Denver of the Westinghouse Electric & Manufacturing Company, read an interesting paper on "The Electric Range." Mr. Manuel urged the members of the association to look carefully into electrical cooking and deplored the fact that out of 1,000,000 users of electricity served by the member companies of the association at least 400,000 were not encouraged to cook electrically. Mr. Manuel showed by a series of stereopticon slides how the load-factor was affected by various installations of electric ranges, demonstrating that the cooking load did not affect the peak load. He said that, in his opinion, the evolution of the electric range is going to be more rapid than in the case of many other improvements, and he impressed upon the members of the association the importance of appointing a committee to investigate the subject as to the proper range, the proper price for electricity, and the education of the public to "do it electrically."

Clare N. Stannard, secretary of the Denver Gas & Electric Light Company, gave a talk on "Electrical Prosperity Week." Mr. Stannard told of the nation-wide movement to celebrate the week of Nov. 29 to Dec. 4. Throughout this whole country that week will be one of celebration of the prosperity enjoyed, especially in the electrical world. The Society for Electrical Development is ready and willing to assist any one interested in this campaign and has many suggestions to offer, as well as an abundance of advertising matter which is sent free to members and at a nominal cost to non-members.

Talks on Lighting Topics

Saturday morning's session was opened with a talk by S. E. Doane of the National Lamp Works, Cleveland, Ohio. Mr. Doane's subject was "Improvements in Mazda Lamps." He divided his talk into three divisions —lamps which have been developed and which are liable to be developed; policies under which these lamps are being used as they are being developed over the country, and the technical phases of their application. The newest small lamp is a 7.5-watt sign lamp, and the newest large lamp, which has not yet been standardized in outdoor lighting, is a 1500-cp. series and corresponds to the large municipal unit. Mr. Doane suggested that the association appoint a committee to consider the question of voltage standardization over the Colorado territory.

R. Arnold Lewis, illuminating engineer for the General Electric Company at Denver, followed Mr. Doane with a paper on "Modern Practice in Store Lighting." Mr. Lewis told of the various forms of lighting for stores, direct, semi-indirect and indirect, and showed where each could be used to its best advantage.

The last paper of the convention, "Safety Rules for the Construction of Stations and Lines," prepared by W. J. Canada of the Bureau of Standards, Washington, D. C., was read by H. S. Russell, as Mr. Canada was unavoidably absent. In his paper Mr. Canada gave the general rules for electrical construction and the safeguards to be observed. After a thorough treatment of his subject, he closed by referring to the adoption of a national safety code for use in Colorado and neighboring States, and to the valuable assistance rendered in its preparation by members of the Colorado association.

Following is the list of officers elected: President, John J. Cooper, Denver, Col., secretary Gilpin County Light, Heat & Power Company; vice-president, L. P. Hammond, Denver, Col., general manager Colorado Power Company; secretary and treasurer, Thomas F. Kennedy, Denver Gas & Electric Light Company. The executive committee will comprise H. U. Wallace, Boulder, Col., vice-president and general manager Western Light & Power Company; W. J. Barker, Denver, Col., vice-president and general manager Denver Gas & Electric Light Company; F. P. Wood, Trinidad, Col., general manager Trinidad Electric Transmission, Railway & Gas Company; W. F. Raber (ex officio), Pueblo, Col., general manager Arkansas Valley Railway, Light & Power Company.

July Electrical Exports

The electrical export trade was over 60 per cent greater in July, 1915, than in July, 1914. The figures compiled by the Bureau of Foreign and Domestic Commerce show the total increase to have been over $700,000. For the first seven months of 1914 and 1915 there is a difference in favor of the present year of more than $500,000.

The principal gains in July were in wire, motors and telephones. The trade in generators showed a slight falling off; in fact, the total for the year up through July is considerably less than for last year. While the motor trade showed a large gain in July, the total for the seven months ended July still showed a large decrease in comparison with the first seven months of 1914. The same is true to a less extent of telephones.

The largest total increase during the seven months was in insulated wire and cables, in which trade the value of the 1915 exports was $650,000 greater than that of the 1914 exports. Interior wiring supplies, batteries and meters and other measuring apparatus also registered large increases.

ELECTRICAL EXPORTS FOR JULY AND FOR SEVEN-MONTH PERIOD

	July		Seven Months Ended July	
	1915	1914	1915	1914
Electrical machinery, appliances and instruments:				
Batteries	$91,344	$59,714	$749,485	$386,231
Dynamos or generators	156,191	195,983	1,232,617	1,632,095
Fans	28,438	23,629	215,268	248,116
Insulated wire and cables	817,379	127,697	1,513,217	863,136
Interior wiring supplies, etc., including fixtures	80,933	45,077	555,964	357,893
Lamps:				
Arc	433	1,672	15,212	28,249
Incandescent—				
Carbon-filament	9,715	3,143	80,202	59,732
Metal-filament	55,929	13,581	346,473	109,037
Meters and other measuring instruments	55,463	31,585	338,993	31,585
Motors	381,695	161,798	1,765,446	2,028,645
Telegraph instruments (including wireless apparatus)	8,536	5,340	58,653	71,749
Telephones	101,277	59,347	632,018	692,515
Transformers	73,292	72,443	346,145	655,125
All others	916,682	614,351	5,321,455	5,466,451
Total electrical machinery, etc	$2,147,307	$1,415,360	$13,171,148	$12,630,559

Boiler Code Committee Reports Favorable Progress on Pacific Coast

Thomas E. Durban, chairman of the committee on uniform standard specifications for boilers, reports that the outlook on the Pacific Coast and in Minnesota is bright for the adoption of the American Society of Mechanical Engineers' boiler code. In California the A. S. M. E. code has been favorably received by John R. Brownell, commissioner of public safety. The committee appointed by the commissioner to act on this matter, while favoring the part of the code on new boilers, believes the specifications on old boilers to be too drastic. The revised code will be adopted about Jan. 1, 1917, it is reported.

Although five efforts made through the Legislature to have Oregon adopt the code have been fruitless, the matter has been threshed out, and it is anticipated that, with the assistance of O. B. Hoff, commissioner of labor, and Carl F. Caulfield, deputy commissioner, the next Legislature will be induced to give the State Labor Bureau power to adopt the code. Adoption of the code in Washington is being supported by R. M. Murray, chief inspector of the city of Seattle. The fact that existing boiler specifications in Seattle, Tacoma and Spokane differ considerably has made the State authorities alive to the necessity of a standard code throughout the State. In Minnesota it was not deemed advisable to take up the movement until the Legislature meets in 1917.

Conference on National Safety Code at Bureau of Standards, Washington

The deferred conference in Washington on the proposed National Electrical Safety Code will be held at the Bureau of Standards on Oct. 27 and 28, 1915. Official delegates have already been appointed from the following organizations: The American Institute of Electrical Engineers, the National Electric Light Association, the American Electric Railway Association, the American Railway Association, the Independent Telephone Association, the Association of American Railway Telegraph Superintendents, the American Telephone & Telegraph Company, the Western Union Telegraph Company, the Postal Telegraph Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company, the National Fire Protection Association, the Workmen's Compensation Service Bureau, the National Safety Council, the National Electrical Contractors' Association, the International Brotherhood of Electrical Workers, the International Association of Municipal Electricians, and the Western Association of Electrical Inspectors.

State, industrial and public service commissions and municipalities will also be represented. In addition, a number of electrical engineers, representing the different groups of engineers with whom conferences have been held by the Bureau of Standards from time to time, will attend by special invitation. Among the places where such conferences have been held are the following: Boston, New York City, Philadelphia, Cleveland, Columbus, Chicago, St. Louis, Omaha, Denver, Los Angeles, San Francisco, Portland, Seattle and Boise.

The Bureau of Standards will report to the conference concerning the work which has been done in the preparation of the proposed National Electrical Safety Code and present the latest revised copy of the text of this code. It will also present some recommendations with regard to the method of revising the code in future and of its administration by the various States and municipalities. This will be followed by a discussion of the code and its administration and of the subject of electrical inspections by public authorities. All proposals in writing for amendments to the code as submitted to the conference will be referred to a special committee which will report back to the conference on the second day. After this report has been presented and discussed, it is hoped that the conference will approve the code as amended. The Bureau of Standards will recommend, however, that the code shall not be made mandatory until after its tentative use for one year, in order to give the commissions and municipal authorities, as well as the utility companies, an opportunity to become thoroughly familiar with it and to permit the experience of one year to be utilized in its further revision.

A revision of the proposed code has been made during the summer, and on Sept. 1 revised copies were sent out to a large number of persons with whom the Bureau of Standards had been in conference or correspondence. Replies have been received from a number giving additional suggestions for the further improvement of the code. These latest suggestions will be used in preparing the final draft to be submitted to the conference for discussion and approval.

Developments in Plans for Nation-Wide Celebration of Electrical Prosperity Week

Electrical Prosperity Week activities are speeding up, and each mail of the Society for Electrical Development contains fresh details of the plans and successes of the local committees. Charles L. Edgar, president of the Boston Edison company, states that space has been secured for Electrical Prosperity Week car cards in 1400 street cars in Boston. W. H. Atkins, general superintendent of the same company, estimates that $35,000 will be spent on advertising in New England in addition to the advertising matter furnished by the society.

Plans are in progress to have the United States government recognize the campaign to the extent of authorizing the use of a special form of cancellation stamp up to Dec. 1. The proposal has been set in motion through Senators Lodge and Weeks of Massachusetts.

Louisville, Ky., is making large preparations for the celebration of the week. Each of the seven days will be separately named, and particular appeals will be made as the names suggest. Names suggested for some of the days are: "Suburban Day," "Household Day," "Ladies' Day," "Fathers' Day" and "Mothers' Day."

Souris, Manitoba, plans to have an electrical show during the week in which every electrical man and many of the wholesale firms of other industries will exhibit.

Publicity in the Local Electrical Press

Many local newspapers have signified their intention of running special electrical editions. Among those that have already set out a special issue are the Springfield *Republican*, Albany *Knickerbocker Press*, Buffalo *Courier*, South Bend *Tribune* and Houston *Chronicle*.

A letter has been sent to 1100 advertising agencies all over the country suggesting that when their advertising copy contains illustrations of household devices they should use electrical devices rather than the old-fashioned kind. Instead of a broom in the corner a vacuum cleaner is suggested; instead of a coal range an electric range; electric lighting instead of other lighting, etc.

The mayor of every city of 5000 or more population in the United States has received a letter from the society outlining the entire Electrical Prosperity Week movement. Letters have also been sent to about 2600 secretaries and general managers of the chambers of commerce, boards of trade, merchants' associations and other civic and neighborhood bodies throughout the country, and many replies state that the week has been accepted as an opportunity to establish a "white way" and to develop a "city slogan" sign. One board of trade announces a "Peace-Prosperity-Preparedness Parade," in which the local military organizations will take part.

The program of the Utah committee includes the lighting of all office buildings, an electric-vehicle endurance run, guessing contests on the amount of candlepower in some unusual lighting display, demonstrations in the University of Utah and in the domestic-science department of the Agricultural College of Utah, an electrical show, the laying of the cornerstone of Salt Lake City's new "white way," and motion pictures. The committee's slogan will be, "Make your Christmas present an electrical one."

Through the Chamber of Commerce, the Portland (Ore.) committee is endeavoring to get the city officials to install extra lighting during the week on Portland's streets and bridges.

Included in the Toledo plan are electric-vehicle parades, an electric show, illumination and decoration of the city, the crowning of a young woman of Toledo as "Electra" during the festivities, and the exhibiting through the city's streets and in the small towns about Toledo of a railroad flat car fixed up as an electrical home and exhibiting appliances used in the household and about the farm.

The 300 students of the department of electrical engineering of the University of Illinois have adopted the week's campaign as a special subject for study. "These students will soon come into the electrical industry to fill responsible positions," says Prof. L. V. James, "and they enter upon the course with great enthusiasm."

A Commercial-Vehicle Tug-of-War at Salt Lake City

Among the many interesting activities of the week the following stand out as unusually interesting: A tug-of-war for electric and gasoline trucks in Salt Lake City, outdoor static discharges and electric-vehicle races in Denver, and a household-appliance campaign under the auspices of women's clubs in Idaho.

The Cleveland committee has worked out a plan having twenty-nine different lines of activity. Among these are the following: A small Electrical Prosperity Week pennant to be placed on all automobiles owned by members of the industry; all hotels in the city to serve dishes with appropriate electrical names; arrangements to be made for a special discount to be given by contractors on all orders for wiring taken during the week; stores giving trading stamps to be urged to make Electrical Prosperity Week a double-stamp week; a "Goddess Electra" "missing-woman" contest with an electrical prize for the first person approaching her and saying, "You are the Goddess of Electricity."

The opening gun of the campaign to make Electrical Prosperity Week successful in Colorado was a full-page advertisement in the Denver *Post* telling the story of Electrical Prosperity Week and showing Colorado's electrical statistics, together with those of the country at large.

The New England district committee is forming local committees in all the cities of New England, and a meeting of the chairmen of these local committees will be held soon in Boston to consider further plans. On Oct. 1 a joint meeting of the salesmen of the electrical jobbers in Boston was addressed by H. W. Alexander, director of publicity of the movement.

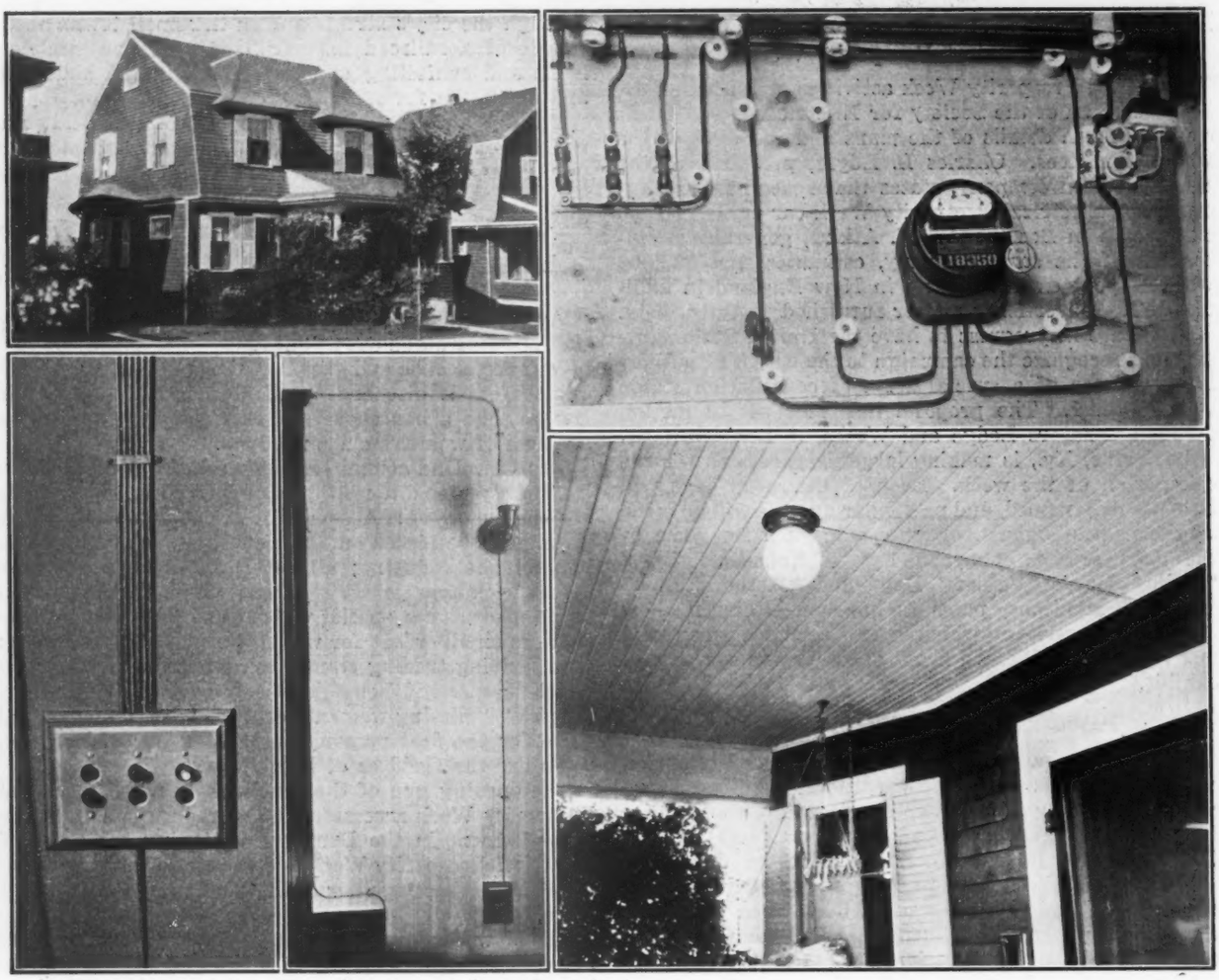
Plans of Ohio Cities for Prosperity Week

The Dayton (Ohio) Jovians pledged support at a meeting held on Sept. 21, which was addressed by J. M. Wakeman, general manager of the society. City Manager H. M. Waite and former Governor J. M. Cox were present to participate in the Jovian celebration.

At Cincinnati, Sept. 22, Mr. Wakeman addressed the members of the Electric Club. The meeting was attended by many city officials, who indorsed the campaign. W. W. Freeman, president Union Gas & Electric Company, pledged the hearty support of his company. Cincinnati is planning to have an electric show, parades, etc. The Pittsburgh Electrical Prosperity Week committee met with Mr. Wakeman and discussed the work of the society at a meeting held in the Fort Pitt Hotel Sept. 23. A general Pittsburgh meeting will be held Oct. 8 to which representatives of all electrical interests and city officials will be invited.

Electrical Prosperity Week was indorsed at the convention of the Southeastern Section of the National Electric Light Association at Asheville, N. C. It met with the hearty approval of the delegates, who pledged their support in the interests of the campaign in the South.

The society is obtaining interviews from fire chiefs and police-department heads all over the country in which great stress is placed on the safety, from both fire and crime, afforded by electricity.



THE FIRST HOUSE IN AMERICA TO BE WIRED WITH BARE CONCENTRIC CONDUCTOR—DWELLING IN DORCHESTER, BOSTON, SHOWING METER ENTRY, GANG SWITCH, TYPICAL OUTLET CONSTRUCTION, AND PORCH-LAMP WIRING

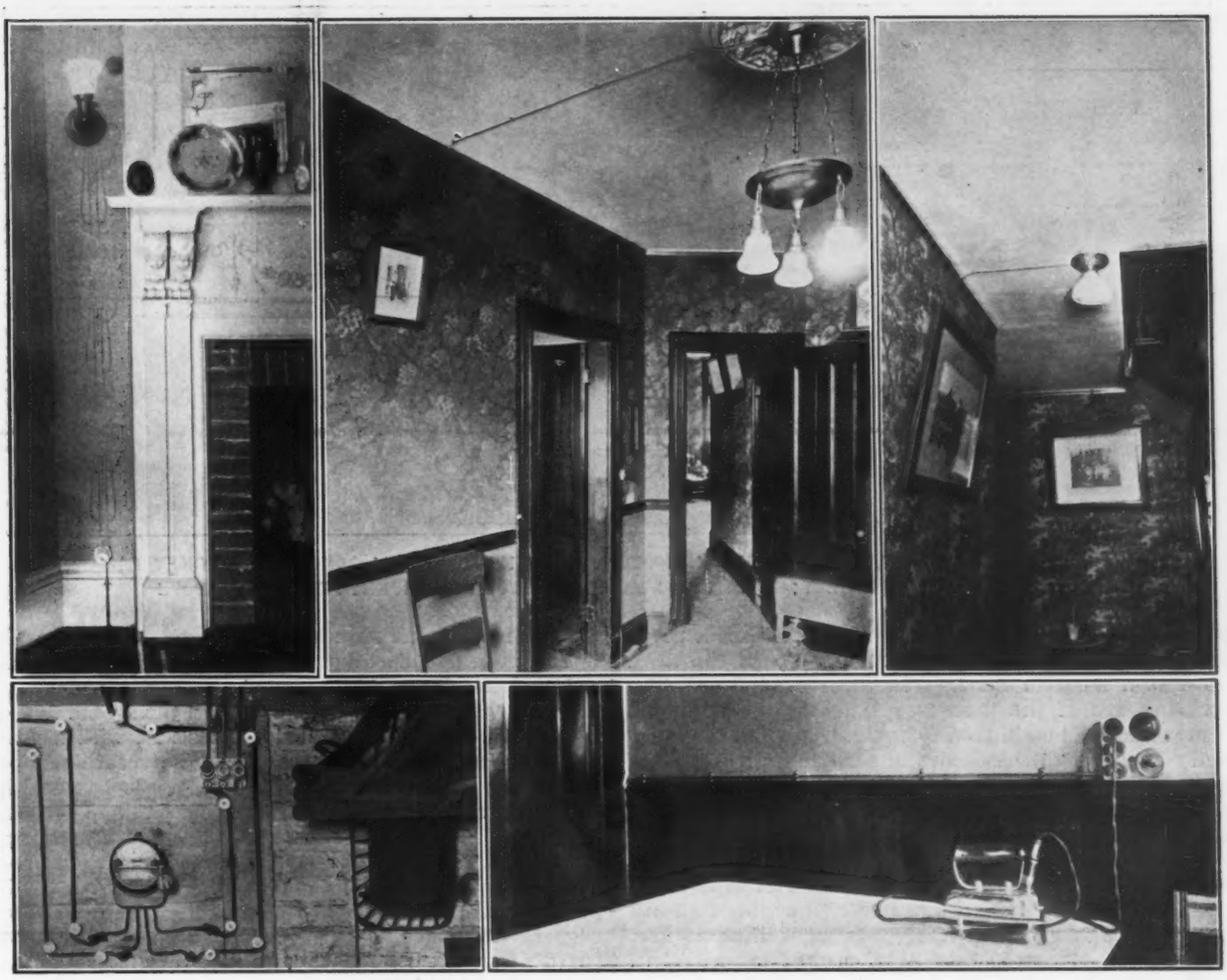
The First Installation of Bare

Noteworthy Features of Three Houses at Boston Edison Company to Demonstrate Applicability

BY special permission of the Boston Board of Fire Underwriters and the Boston Commissioner of Wires, three houses in Boston were equipped during the past summer with bare concentric wiring, these being the first installations of the kind in America. The insurance and city authorities authorized these installations as an experimental demonstration of the applicability of bare concentric wire to interior-wiring conditions in this country, interest in the matter having been widely developed in the United States during the last eighteen months as a result of the investigations of S. E. Doane and others in Europe prior to the outbreak of the war and also of the activities of the N. E. L. A. committee on wiring. Early in the spring about a mile of bare concentric wire was manufactured by the General Electric Company through the special interest of H. R. Sargent, Schenectady, N. Y., on an order from the Boston Edison company for experimental use, and the first installations were carried out by Herbert S. Potter, a Boston electrical contractor.

An exhaustive article by Mr. Doane on the use of bare concentric wire abroad was published in the ELECTRICAL WORLD of May 23, 1914, and later issues have carried frequent references to this material and to its possible application in America, particularly in relation to the wiring of existing buildings. The experience of central stations abroad has led to the belief that if this type of construction is standardized here it will enable a great number of buildings not now equipped with electric service to be wired at lower cost than by using existing systems, not only without sacrificing in any way the safety of the installation, but possibly with an actual gain in this respect. The manufacturers are now at work upon fittings specially adapted to this type of wiring under American conditions, and considerable improvement in the mechanical side of such installations is anticipated in the near future. In the Boston installations it was necessary to adapt existing fittings to the new type of service, and various lines of improvement were discovered as the work progressed. In view of the experimental character of the work under these conditions, the experienced wireman will find points to criticise, but the installations are thought to be most significant despite their admittedly pioneer characteristics.

The first of the three houses thus wired is in Dorchester and, like the other houses, contains about 500 ft. of No. 14 B. & S. gage bare concentric wire. There are twenty-five outlets, which supply six 15-watt, five 25-watt and ten 40-watt lamps. Two of the rooms in this residence were wired with concealed conduit in the usual manner, all other portions of the house being equipped with bare concentric wire. The leads to the meter are



THE SECOND CONCENTRICALLY WIRED HOUSE, DORCHESTER—PARLOR BRACKET LAMP AND BASEBOARD OUTLET, DINING-ROOM WIRING, FIXTURE IN HALL, SERVICE ENTRY IN BASEMENT, AND ELECTRIC-IRON OUTLET WITH PILOT LAMP

Concentric Wiring in America

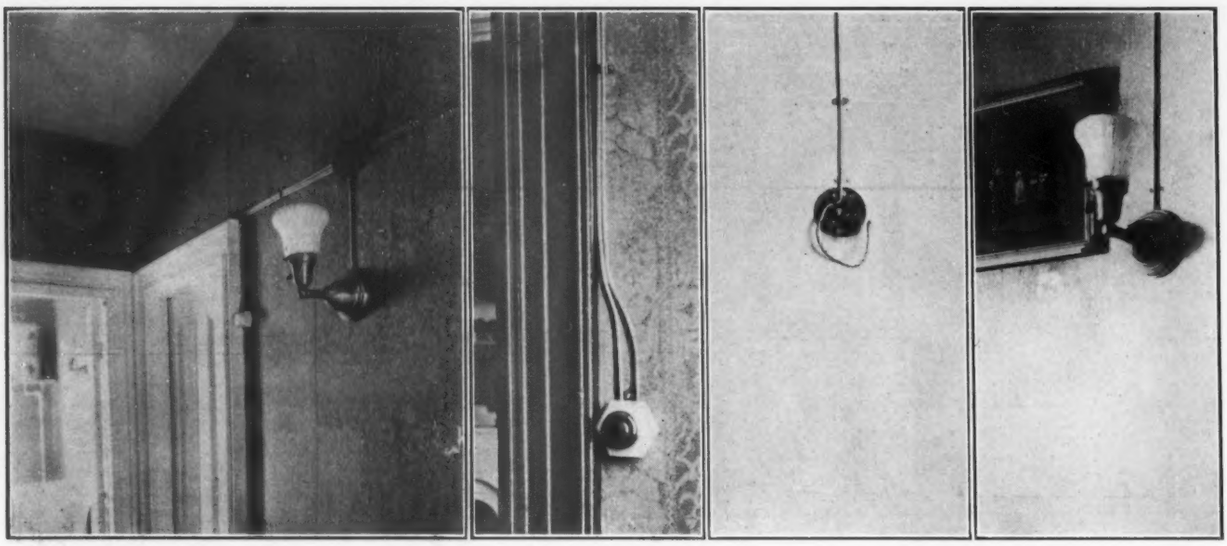
Wired Experimentally on Initiative of Boston of Construction to American Conditions

brought into the house by overhead service carried in pipe to a condulet from which the leads are run open to the cut-out box and meter, one side of the circuit being grounded to the entering pipe with a standard ground clamp. A No. 6 tap runs from the grounded leg across the cellar to a water-pipe connection. Beyond the meter taps are taken at a fuse block to feed the two rooms wired in conduit, the leads being continued to a point near the upper left-hand corner of the board, where one side is dropped to form a short horizontal bus from which three taps are taken through inclosed fuses of 10-amp. rating. Each fuse controls one bare concentric circuit, the sheath of the wire being connected to the upper lead from the meter, while the fuses are connected to the inside conductor of the concentric run in each instance. The connection between the sheath and the meter lead is made by "twist-ons" of the European type, one end of the twist-on being soldered to the meter lead and the other merely clamped around the sheath as shown. The meter board measures 3 ft. 8 in. by 2 ft. 6 in. in length and width, being of 0.875-in. plank. In the extreme upper left-hand corner of the board a ground connection is made between the sheaths and the No. 6 lead running to the water pipe. The three bare concentric wires leading from the meter board feed several lamp circuits in the house through appropriate junction boxes.

In the sewing-room of the Dorchester house two outlets were provided, one for a 60-watt bracket lamp mounted on the wall about 6 ft. above the floor, and the other for a baseboard receptacle available for sewing-machine motor or other service. The wire is about 3/16 in. in outside diameter and is attached to the wall on the surface of the papering by 1.25-in. by 0.375-in. metal clips screwed into the laths. In the future outlets will, as a general rule of practice, be fed from above, thus avoiding as far as possible bringing the concentric wire so close to the floor that it is likely to be struck by chairs, brooms or vacuum-cleaner handles, etc., when moving furniture and other domestic equipment about.

In the first house wired the bracket lamps were mounted on circular wooden blocks about 0.875 in. thick, at the request of the insurance interests, but in the later work the canopy surmounts a small metal plate of "Renim" make, which provides ample clearance. This plate is 3.5 in. in diameter and had to be slotted at the top with a hack saw in order to admit the concentric wire. It is screwed into the wall at three points and affords a convenient canopy base prior to the development of a standard base for this type of service.

In the first Dorchester house a gang of three-way switches is installed in a wall plate in the front hall, as



CONCENTRIC-WIRED DWELLING, JAMAICA PLAIN, BOSTON, SHOWING JUNCTION BOX WITH BRACKET LAMP AND VACUUM-CLEANER OUTLET; SWITCH AND BASE, AND TYPICAL BRACKET FEED FROM ABOVE

shown in the illustration. One switch controls a porch lamp, another a lamp in the front hall, and the third governs a lamp in the hall on the second floor. The switches are of the three-way type for interior lamp control, and the main feed is brought up from the cellar and runs along the baseboard of the hall until it reaches a point immediately under the plate, when it rises to the latter as shown, passing under the wooden base to the terminal points. Five concentric leads leave the switch plate at the top for the various services above enumerated. Although these leads are run exposed on the face of an attractive wall paper, the tinned sheath of the wire is rendered less conspicuous than at first might seem to be the case by a coat of brown paint.

The porch lamp in this house is supplied by a concentric-wire circuit run from the door frame across the ceiling to the lamp base. Here again, by painting the wire to accord with the piazza ceiling and to match the shingles, the feed is rendered inconspicuous, being much smaller than a gas pipe and only a trifle larger than the capillary tubing used in acetylene distributing systems.

The Second Concentric-Wired House in Dorchester

The second house wired, also in Dorchester, is provided with bare concentric equipment throughout. It has seventeen outlets, supplying lamps ranging from 15 watts to 60 watts in size, and is fed by 3-in. iron conduit run from an adjacent manhole to a 3-ft. 5-in. by 2-ft. 6-in. service board in the cellar. Beyond the meter the leads are separated, one being connected bus-fashion to the terminals of three fuse plugs, while the other lead is carried upward and connected to the sheaths of the bare concentric distribution circuits. The ground connection is made from the sheath to the water pipe as before, and "twist-ons" are used. There are three main circuits in the house, bunched with common clips and running along the ceiling of the cellar to distributing points from which the upstairs services are taken. In the case of the cellar drop lamp the bare concentric wire is run from a junction box on the ceiling to a standard rosette, the connections at the latter being made by the inside conductor and by the short lead run from the sheath as indicated. Each circuit is fused at 10 amp. A 5-amp. meter is installed and the fuses are mounted on a common 3-in. by 4-in. block. One circuit runs directly to an electric flatiron receptacle in the kitchen. It is carried up from the cellar and run upward along the wall inside a mechanical protecting sheath of brass until it reaches the level of the paneling top, whence it is run open and bare horizontally to a porcelain block carrying the fuses, pilot lamp, switch and receptacle.

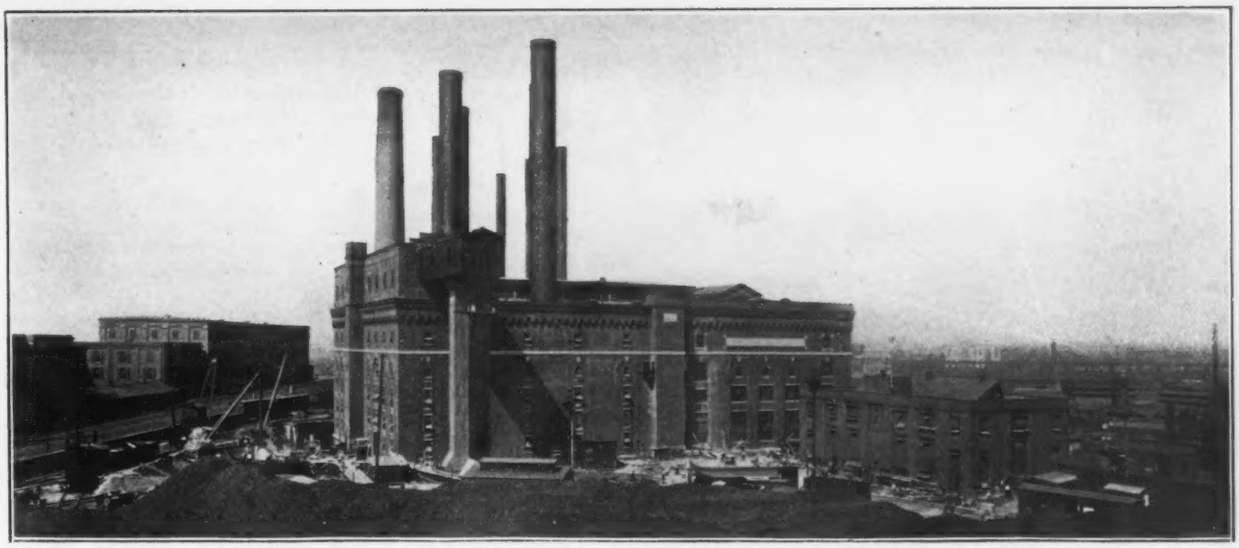
In the wiring of the dining-room in the second house the feed is brought up through the cellar, with a protecting sheath which it is hoped in the future can be eliminated by running the lead behind the baseboard, and is carried along the door frame to a snap switch. Thence it rises to the height of the picture molding, runs parallel to the latter along the face of dark-colored wall-paper, and crosses the ceiling in a short run leading to the fixture canopy. Mechanical protection at the edge of the canopy is provided by a short fiber tube surrounding the concentric wire sheath. Lamps of 15-watt, 40-watt and 60-watt rating are installed, ordinary rubber-covered wire being run from the canopy to the lamp bases. The lamps are hung about 4 ft. above the table. In this house one circuit feeds the flatiron, another the first floor, and a third the second floor.

The Jamaica Plain House

The third house of the trio wired is at Jamaica Plain. The feed is by overhead service through pipe and condulet to a meter board in the basement just below the front hall. The general arrangement of connections is as previously described. Three bare concentric circuits are used, with a 6-amp. fuse in one lead of each, "twist-on" connections, and ground wire to water pipe. One flatiron and two lighting circuits are provided. The junction boxes are of the usual recessed type, inverted and slotted to receive the concentric conductors. There are eighteen outlets in the house.

Diagonal pliers, ordinary pliers and a knife were the principal tools used in the installation of these wiring jobs, with a home-made bending block 5 in. long, 1.5 in. wide, and provided with a 5/16-in. slot 0.125 in. deep. The minimum radius of bending was about 2 in., the sheath having a tendency to crack below this. In view of the experimental nature of the work, no cost figures are available, but it was found that the cost decreased rapidly between the first and third jobs, the last being about on a par with the cost of wiring according to the present Boston Edison house campaign.

With improved fittings and experience, the field of this kind of wiring is thought to be assured. The occupants of the residences so wired are satisfied with the service, and the wiremen who put in the installations were enthusiastic in praise of the concentric conductors.



PHILADELPHIA ELECTRIC COMPANY'S NEW STATION, CONTAINING LARGEST TURBO-GENERATOR YET BUILT—35,000 KW.

Metropolitan Needs and Sizes of Prime Movers

Some Tendencies That Point to an Increase in the Size of Turbo-Generators and the Feasibility of Making and Operating 50,000-Kw. Units

WITH the advent of the 20,000-kw. steam turbine many of the problems then confronting large modern generating stations were solved. However, the equipment soon proved to be too small to meet the rapidly advancing loads. The installation of 30,000-kw. and 35,000-kw. units since made has been another step forward in meeting pressing metropolitan needs, and now units of 50,000-kw. rating are being seriously considered. High economy and reliability are not the only desiderata in increasing the size of prime movers. Labor, real estate and other considerations depending upon loads, design and location of the plant in a large city are factors almost as important. Recently many of the large lighting companies have acquired huge railway loads, it being generally recognized by railway officials that this is advantageous to them.

In New York City 30,000-kw. units are used to handle the elevated-railway and subway demand of the Interborough Rapid Transit Company. Units of 20,000 kw. are used by the central stations of New York, Cleveland, Detroit and Chicago, and 30,000-kw. units in New York, Chicago and Philadelphia. Philadelphia has the distinction of possessing the largest steam turbine thus far installed, the 35,000-kw. unit shown in an accompanying illustration.

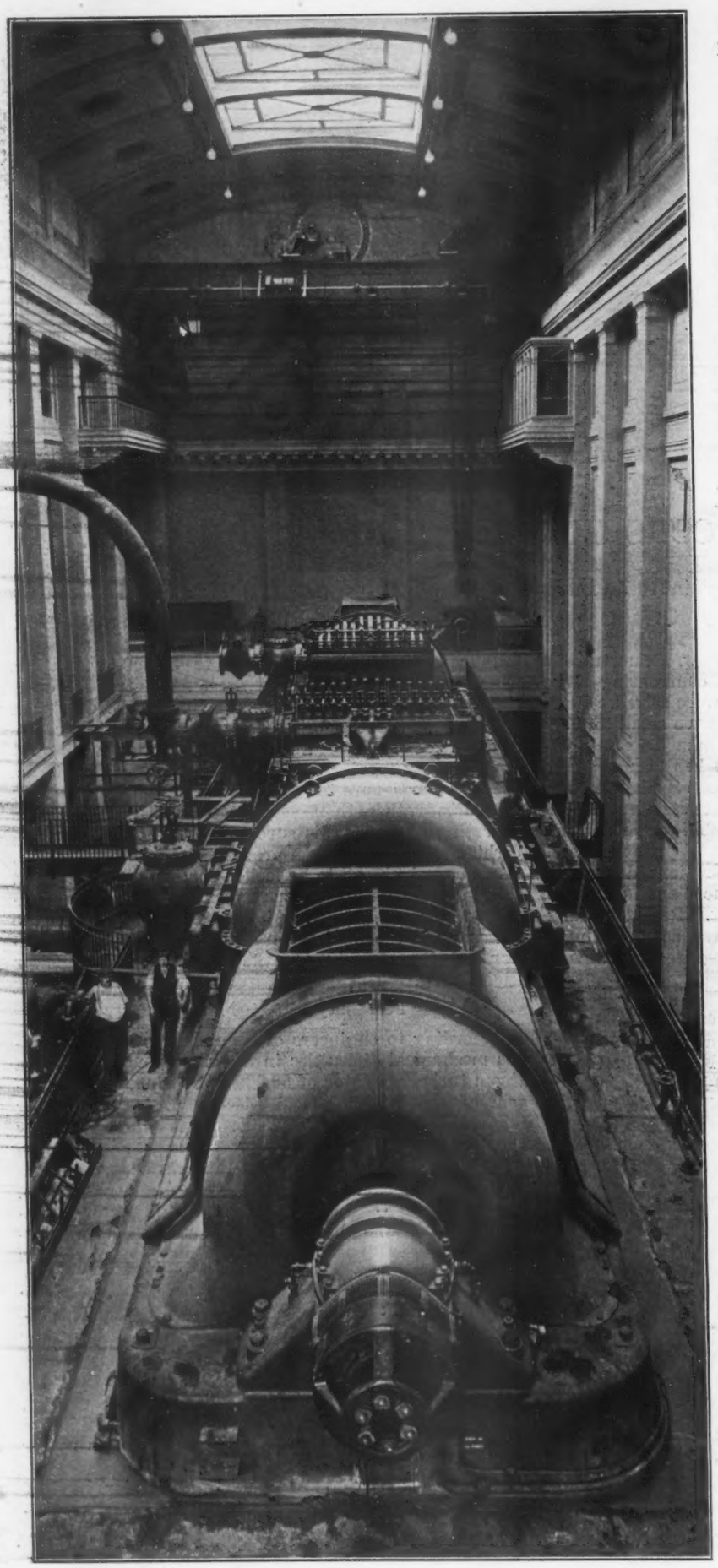
Higher Steam Pressures Probable

Further increase in size of turbo-generators beyond 35,000 kw., and even future operation of existing smaller units, suggest new problems in station design and operating practice. Higher steam pressures are certain, and these will introduce new problems in piping and fittings and possibly a further development in the methods of driving auxiliaries. In the discussion on economics of power-station design at the recent International Engineering Congress at San Francisco, H. H. Barnes, Jr., engineer in the New York office of the General Electric Company, spoke of the tendencies in steam practice, intimating that boiler pressures much higher than 250 lb. would be found feasible and economical. A pressure as high as 1000 lb. was suggested as a possibility for turbo-generators of 40,000-kw. to 50,000-kw. rating. That these high pressures would not introduce operating difficulties is the opinion of C. W. E. Clarke of the Stone & Webster organization, Boston. To a representative of the ELECTRICAL WORLD Mr. Clarke said that it is entirely feasible to build steam boilers for 400 lb. pressure per square inch and that the use of high steam pressures rather than very high superheat, with its operating difficulties, is sure to mark decided gains in turbine efficiency. Steam pressures of 500 lb. to 600 lb. per square inch are to be looked for in due course, and this means a gain of about 9 per cent in turbine efficiency. The 50,000-kw. unit may be said to be on the horizon, and the whole problem of high-pressure operation is being opened up by the demands of large power engineering.

Feasibility of 50,000-Kw. Units

According to engineers of repute there are few serious mechanical difficulties in the way of constructing a steam turbo-generator of 50,000-kw. rating. P. M. Lincoln of the Westinghouse Electric & Manufacturing Company in a recent paper said: "It is astonishing how rapidly we have advanced of late years in our ideas on this matter of size." He cited the first 6000-kw. units installed in 1898 in the Manhattan Railway station, which were driven by reciprocating engines. That station now contains three 30,000-kw. units, but in physical dimensions and in weight the reciprocating units still hold the record. However, in ability to generate electricity they have been left far behind. "To-day," said Mr. Lincoln, "we talk of the coming 50,000-kw. turbo-generator with as much freedom as we did of those 6000-kw. reciprocating engine-driven units a short seventeen years ago. How much further this increase in size of units will go I make no attempt to predict, but it is safe to predict that the capacity of the future unit will be fixed by the demand for such units rather than by any inability to produce them."

On this same point, Prof. Edward F. Miller, head of the department of mechanical engineering, Massachu-



MAMMOTH STEAM TURBINE

Philadelphia Electric Company About to Place a 35,000-Kw. Unit, the Largest in the World, in Operation.

The accompanying interior view of the new A-2 Christian Street station of the Philadelphia Electric Company shows the two largest steam turbo-generating sets ever built. The combined rating of these two sets—namely, 65,000 kw.—is the largest for any pair of units yet installed in any station in the world. The turbo-generator set in the foreground is rated at 30,000 kw., 13,200 volts, twenty-five cycles, three-phase, and the one in the background is rated at 35,000 kw., 13,200 volts, sixty cycles, three-phase. Both units consist of horizontal Curtis turbine elements directly connected to the generators. The turbine element of the 35,000-kw. machine has thirteen stages and operates at 215 lb. pressure, 150 deg. Fahr. superheat, exhausting into a 50,000-sq. ft. center-flow surface condenser, the condenser also being the largest yet installed for a steam turbine.

The generator element of this 35,000-kw. set has a current output of 1460 amp. per phase at full load at 90 per cent power-factor. The rotating field member is of six-pole design driven at 1200 r.p.m. with a 150-kw., 250-volt, 600-amp. shunt-wound exciter mounted on the end of the same shaft. When exhausting against a back pressure of 1.5 in of mercury col mn, absolute pressure, the steam consumption, according to guarantees, will be 11.8 lb. per kilowatt-hour at the most efficient load—namely, 25,000 kw.—and 12.5 lb. per kilowatt-hour at full rated load of 35,000 kw. The entire machine measures 63 ft. 2 in. in over-all length, is 21 ft. 7 in. wide and 15 ft. 10 in. high.

The station building, illustrated on page 799, is known as A-2 and adjoins the A-1 station on Christian Street. The new structure measures 188 ft. in length by 262 ft. in width and is 98 ft. high. The part fronting on Christian Street is devoted to station switching apparatus and turbine room. This part comprises one-third of the total building floor area, and the boiler house takes up the remainder. The total rating of stations A-1 and A-2 is 151,000 kw. in nine generating units, the seven sets of station A-1 having an aggregate rating of 86,000 kw. The traction demand is nearly one-third of the load on the stations of the Philadelphia Electric Company. Part of this is furnished at twenty-five cycles and part at sixty cycles for feeding energy to synchronous converters of the same frequency. In addition, twenty-five-cycle, single-phase energy will be used at the rate of several thousand kilowatts by the Pennsylvania Railroad electrified section. Last year the total output of the Philadelphia Electric Company's generating station was 250,697,952 kw.-hr., and the peak load was 77,728 kw. The new Christian Street station, with its 65,000-kw. in turbo-generators, is, therefore, the outcome of these growing conditions and provides for meeting economically the conditions in Philadelphia.

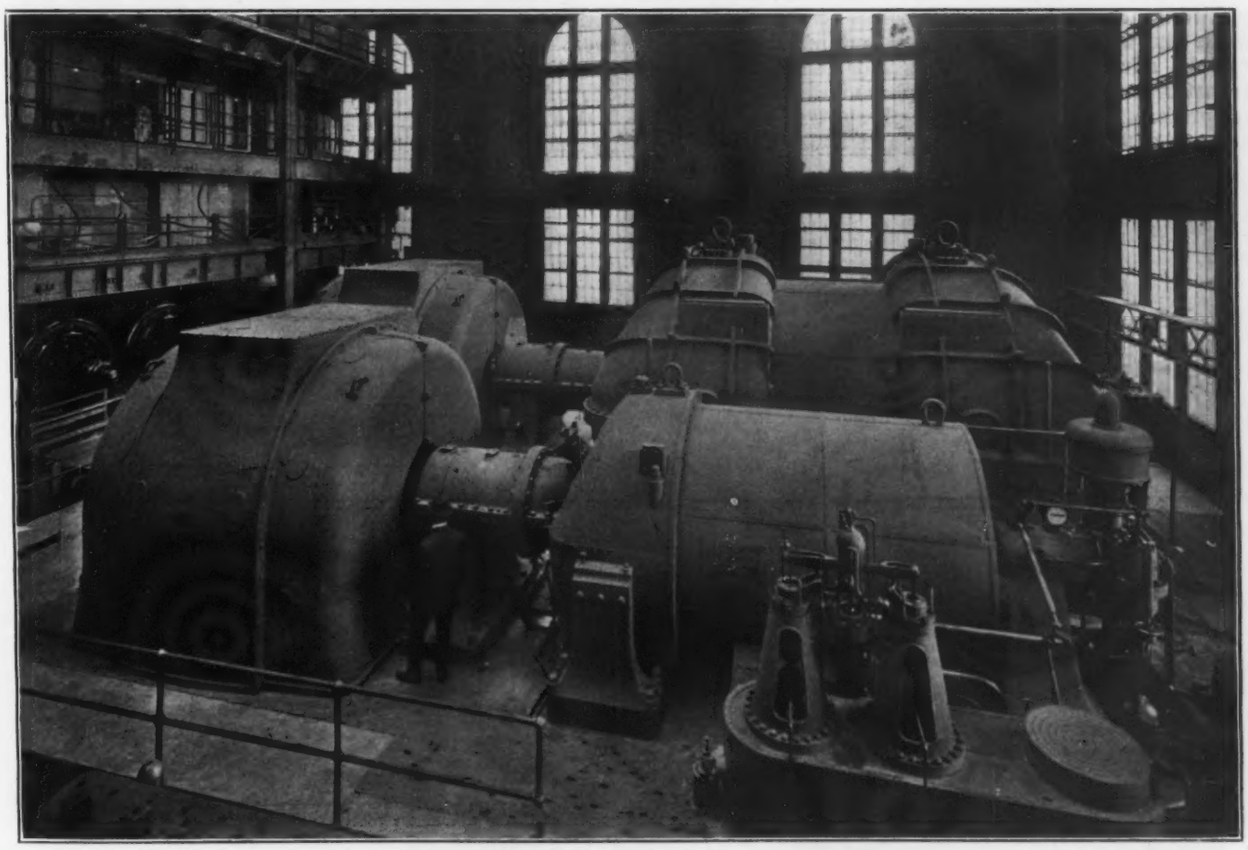
setts Institute of Technology, intimates that with the same steam pressure a 50,000-kw. unit should show slightly better economy than a 35,000-kw. unit in respect to water rates, and that noticeable gains in labor cost should result per unit of output when a machine of such capacity is operated at or near its rating. Professor Miller is of the opinion that along with the design of such units, which can be improved in efficiency but slightly with existing steam pressures and superheats, are likely to come increases of steam pressure marking a new departure in power-plant practice and raising the efficiency on the Rankine cycle considerably above the present maximum of about 73 per cent. These higher boiler pressures introduce some interesting problems in the design of auxiliaries and piping systems, and developments in this direction may be forecast with confidence.

H. G. Stott of the Interborough Rapid Transit Company of New York, referring to the 30,000-kw. turbo-generators of that company, has stated that the large steam turbine has surpassed the gas engine in thermal efficiency, the figure of 26 to 28 per cent for the former being only surpassed by the Diesel type of oil engine. The floor space occupied by the modern horizontal steam turbo-generator, moreover, is about 1/10 to 1/15 sq. ft. per kilowatt.

H. T. Herr of the Westinghouse Machine Company, in a recent address before the Railway Club of Pittsburgh, showed that each of 30,000-kw. units in the Interborough station replaced three 6000-kw. reciprocating engines, and that while five times larger in rating the turbines only cost as much as the 6000-kw. reciprocating units did twelve years ago. Moreover, the same hand-fired boilers used for the 6000-kw. engines were equipped with underfeed stokers and their rating increased to 300 per cent for peak-load operation.

Operating Problems of Large Units

While many engineers are confident that a 50,000-kw. unit will make its appearance shortly, they do not anticipate any operating difficulties. Irving E. Moultrop, assistant superintendent of construction of the Edison Electric Illuminating Company of Boston, believes that no more men would be likely to be required for operating such units, as compared with the 30,000-kw. size, and therefore the saving in labor should be attractive when figured on the kilowatt-hour basis. Without increasing the steam pressure or the superheat, marked gains in water rate can hardly be expected with the 50,000-kw. machine as compared with the 20,000-kw. and 30,000-kw. units. As yet the makers of auxiliaries are probably not fully prepared to meet the demands of such large units. Speaking on the investment, Mr. Moultrop said the value of plant in charge of the operator in the latter case might easily approach $750,000, the horizontal type being the settled standard. The cost of installing such large units is an important factor in relation to reserve capacity and the shape of the load curve. Where the load conditions permit virtually continuous operation at economical water rates, there is little doubt that the 50,000-kw. machine will find an immensely useful field. This will be true only in very large cities. In most cities the load at present is too small to warrant the installation of such a large unit.



ONE OF THE THREE 30,000-KW. TURBO-GENERATING SETS INSTALLED IN THE SEVENTY-FOURTH STREET STATION OF INTERBOROUGH COMPANY, NEW YORK CITY, CARRYING OUT STEAM EXPANSION IN TWO ELEMENTS

This station was laid out for eight of these units, the three mentioned being ordered in 1913. The first one was started Dec. 29, 1914, the second Feb. 24, 1915, and the third July 30, 1915. The units operate at 200 lb. pressure, 120 deg. Fahr. superheat and 29 in. vacuum, and under preliminary test with variable load show a steam consumption between 11.3 lb. and 11.4 lb. per kilowatt-hour when carrying between 32,000 kw. and 33,000 kw. Further tests will be made on these units under constant-load conditions when better economy is expected.

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses

Outdoor-Indoor Design of Substation at East St. Louis, Ill.

How an Economical Layout Was Secured—Why Three-Phase Transformers Were Selected—Use of a Small Cooling Tower for Transformer Circulating Water

SPACE economy, a saving in material and labor and improved operating conditions are among the advantages gained in constructing a substation of the outdoor-indoor type, according to the judgment of the engineers of the E. W. Clark & Company Management Corporation of Columbus, Ohio. A station of this type recently constructed on the lines of the East St. Louis (Ill.) Light & Power Company receives energy from the hydroelectric station at Keokuk, Iowa, for distribution. This station, with a rating of 10,000 kva., occupies a space only 61 ft. wide by 105 ft. long by 31 ft. high, and provides facilities not only for operating all indoor and outdoor equipment but also for repairing the large transformers at the station. The object of the entire design was to place outdoors all equipment which could be operated economically in the open.

The large three-phase transformers and 66,000-volt lightning arresters, when placed out of doors, not only made the building itself smaller but made it possible to take advantage of lower outdoor temperatures for transformer operation. Three-phase units were selected in preference to three single-phase transformers on account of the lower first cost and lower core loss of the former. It is often contended that three single-phase units are preferable to a three-phase unit of like rating because in case of failure of one unit it is still possible to operate the installation with open-delta connection. It is generally agreed, however, that open-delta operation should be limited to comparatively low voltages, so that practically all high-voltage, single-phase transformer banks are installed in fours or sevens, and if trouble develops in one phase the spare unit can immediately be placed in service. This spare phase adds nothing to the available rating, but does add materially to the first cost.

No trouble is expected to develop in the three-phase transformers at East St. Louis, since they are adequately protected. Owing to the fact that it is necessary to have the cores of units of this size shipped separately from the tank, and that it is also more convenient to dry the core and windings before placing them in the tank, arrangements have been made for handling them at the station. In case of damage to one of them, it is possible to move the damaged unit inside the station for repairs. To make this operation as simple as possible, the transformers are mounted on

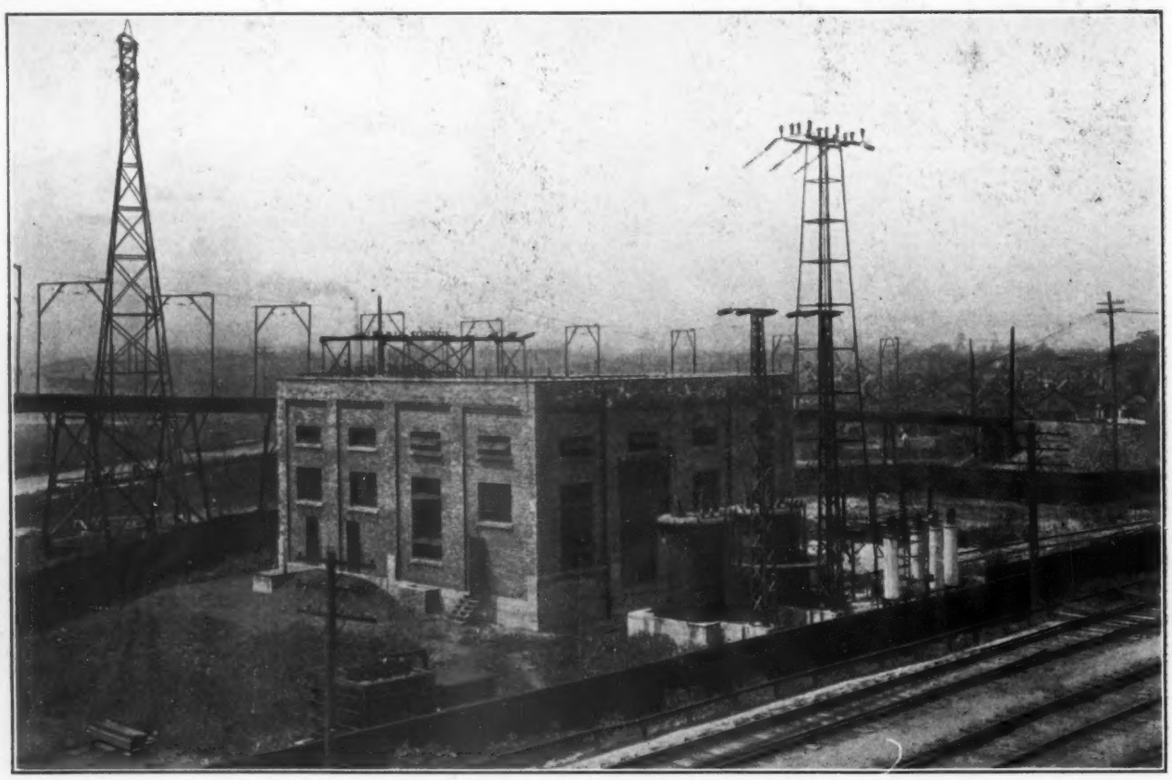


FIG. 1—THE LAKE AVENUE 10,000-KVA. OUTDOOR-INDOOR SUBSTATION OF THE EAST ST. LOUIS (ILL.) LIGHT & POWER COMPANY

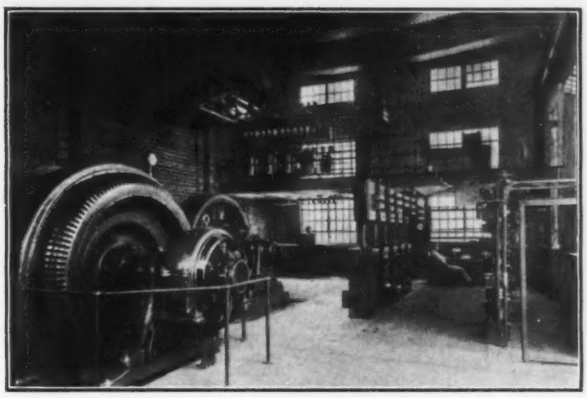


FIG. 2—SUBSTATION INTERIOR, SHOWING SYNCHRONOUS CONVERTER AND A PEDESTAL SWITCHBOARD

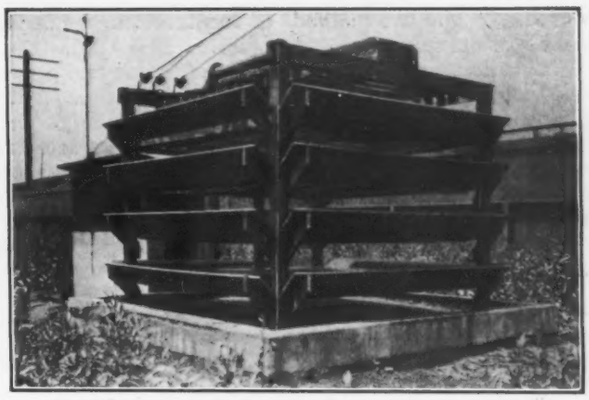


FIG. 4—A SMALL COOLING TOWER THAT SAVES THE EXPENSE OF CIRCULATING WATER FOR THE TRANSFORMERS

four-wheeled trucks which rest on steel rails laid in the transformer foundations. Tracks of like gage have also been laid in the substation floor, which is at the same level as the transformer foundation. Between the building and the transformers there is a railroad spur which is 4 ft. lower than the station floor. To fill the gap between the transformers and the station an ordinary railroad flat car is used. The transformers can be pulled into the station across the car through the large steel door shown in Fig. 1. When indoors, the unit is lifted by a crane and lowered into a transformer pit constructed especially for the purpose. The depth of the pit is such that the core can be lifted from the tank by a traveling crane mounted at the minimum height necessary for handling the other equipment.

Further economy of space in the building has been effected by unusual but judicious placing of the operating mechanism of the oil switches and the busbars. As shown in one of the illustrations, the oil switches are installed in the lower concrete cells, while the solenoid-operating mechanisms which control these switches are mounted on the front walls of the concrete compartments containing the buses. The location of current and potential transformers and disconnecting switches may be seen in the accompanying diagram showing a section of the substation. With this arrangement it is possible to provide ample space for twenty three-phase switch compartments, although the switchroom measures only 15 ft. in width by 12 ft. high by 43 ft. long. A similar arrangement is in use at the Alton substation of this company. In constructing the concrete cells at the latter plant, however, the entire battery of cells was made a solid monolith. At the newer substation parts of the compartments and bus structures were first made as concrete slabs in forms outside the station, and these slabs were set in position later as the remainder of the bus and switch structure was

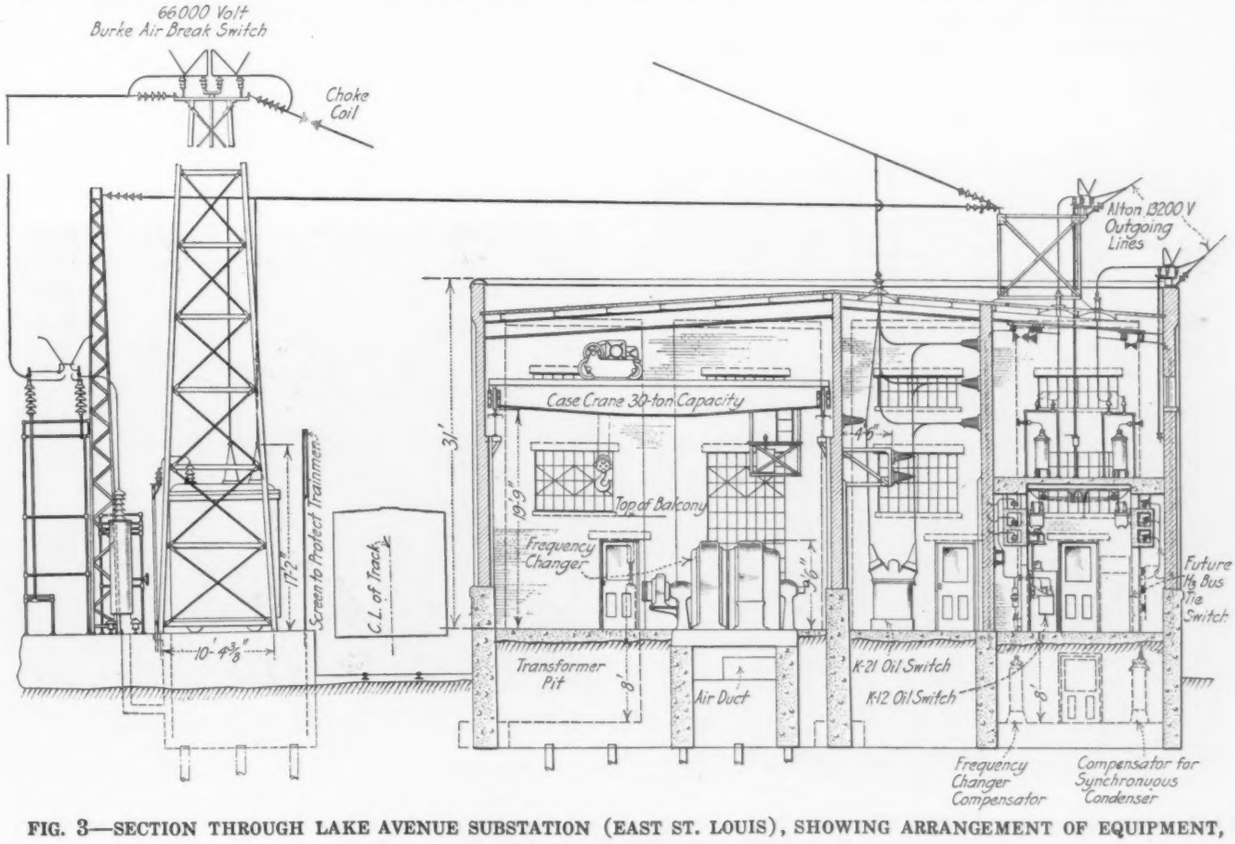


FIG. 3—SECTION THROUGH LAKE AVENUE SUBSTATION (EAST ST. LOUIS), SHOWING ARRANGEMENT OF EQUIPMENT, INCOMING AND OUTGOING LINES

poured. Of the two methods of construction, the latter was found to be much less expensive.

The switchboard is a combination of panels and pedestals. The panels are set in the form of an L, with the pedestals set about 7 ft. in front of the panels. The panelboard is 35 ft. 4 in. long. There are five pedestals, with space for two future ones, which control the 13,200-volt and 66,000-volt apparatus. The equipment on the pedestals, if placed on standard panels, would have added 18 ft. 8 in. to the length of the panelboard.

ELECTRICAL EQUIPMENT OF A 10,000-KVA. SUBSTATION

Two 5000-kva., 66,000/13,200-volt, three-phase, twenty-five-cycle transformers.
One 1500-kva. synchronous condenser with directly connected exciter and Tirrill regulator.
One 1250-kva., twenty-five-sixty-cycle frequency changer with directly connected exciter and Tirrill regulator.
One 500-kva., twenty-five-cycle, 600-volt synchronous converter.
One 750-kva., twenty-five-cycle, 600-volt synchronous converter (future).
One three-phase, 66,000-volt air-break switch.
Four three-phase, 13,200-volt air-break switches.
Two three-phase, 66,000-volt electrically controlled oil switches.
Fourteen three-phase, 13,200-volt electrically controlled oil switches.
One 66,000-volt electrolytic lightning arrester.
Five 13,200-volt electrolytic lightning arresters.
Switching equipment for four 2300-volt, three-phase, sixty-cycle feeders and space for two future three-phase feeders. (No switching equipment for 600-volt direct-current feeders has been installed, but space is provided for six future lines.)
One 60-ft. square-base steel tower for 66,000-volt line.
One 100-ft. square-base steel tower for 13,200-volt line.
One 30-ton electrically operated crane.
One 15-cu. ft. air compressor driven by a direct-current motor.
One 3.5-kw. battery-charging set and 7.5-amp. storage battery for control system.
One 25-kw., 13,200-volt, three-phase auxiliary transformer for station lights and motors.

Another unusual practice at this station is that of cooling and re-circulating the transformer cooling water in a miniature cooling tower. Water is pumped through the two three-phase units at the rate of about 100 gal. per minute by a 5-hp. motor placed in a housing beside the cooling tower. The fact that water purchased from the city is used for cooling the transformer has made the installation of the cooling system profitable.

FIG. 5—SWITCH COMPARTMENTS AND SWITCH-OPERATING MECHANISMS IN A 12-FT. BY 15-FT. BY 43-FT. ROOM

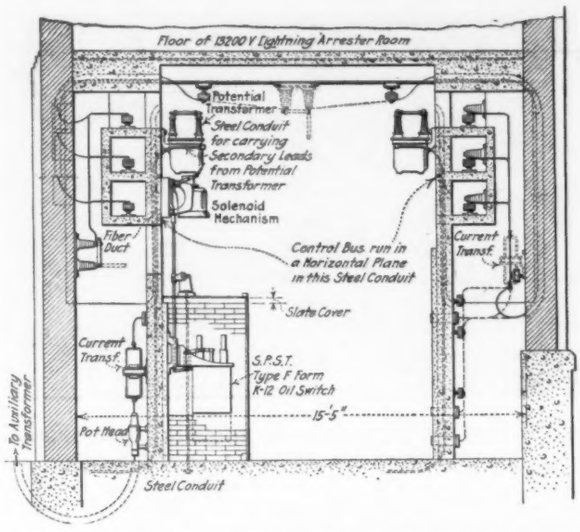


FIG. 6—SECTION SHOWING BUS AND OIL-SWITCH CELLS

The space economy in this substation is best appreciated when it is considered that it provides for a rating of 10,000 kva. The energy is received at 66,000 volts and at 13,200 volts, twenty-five cycles, and distributed through 13,200-volt, twenty-five-cycle, 2300-volt, sixty-cycle, and 600-volt direct-current feeders.

Unit Energy Consumption in Electroplating Establishment

The following data, while not based on the unit output of product, may be utilized in estimating the approximate energy consumption in an electroplating establishment where equipment of similar rating is installed. Direct current for electroplating is furnished by a 3-hp. motor-generator set. Three buffers are employed and driven by belting from a line shaft connected with a 7.5-hp. motor. Lathes, saws and presses which are used intermittently—and rarely ever at the same time—are driven by a 3.5-hp. motor. These electroplating works, which operate under the name of the Gotham Silver Company, New York City, consume about 1225 kw.-hr. per month or, based on the connected load, 87.5 kw.-hr. per horsepower. Energy is used fifty-three hours a week and service is supplied by the United Electric Light & Power Company.

A NEW YORK CITY SILVER-PLATING INSTALLATION

Operating Costs for Oil-Engine Installations

Results Secured by the Use of Different Types of Oil Engines in Small California Plants Arranged for Comparison with Steam-Engine Performance

THE design of heavy-oil engines has been rapidly improved of late years so that now thermal efficiencies as high as 32.5 per cent are being obtained on full load and the reliability of operation is being confirmed by records of many installations. As often pointed out, oil engines are best suited to operate where they can carry uniform loads close to their rating and where the equipment may have to be idle part of the time but in readiness for immediate service. The chief factors which affect their suitablity are the relative costs of coal and oil in any locality and the cost of maintenance.

Some valuable information on the last item, with costs of operating different types of oil engines and comparisons of turbine and Diesel-engine operating expenses, was given in papers presented at the recent Panama-Pacific Exposition meeting of the American Society of Mechanical Engineers by A. H. Goldingham of the De La Vergne Machine Company, New York City, and Walter Holbrook Adams, professor of mechanical engineering at Throop Polytechnic Institute, Pasadena, Cal. These papers have been drawn on for the data presented in this article.

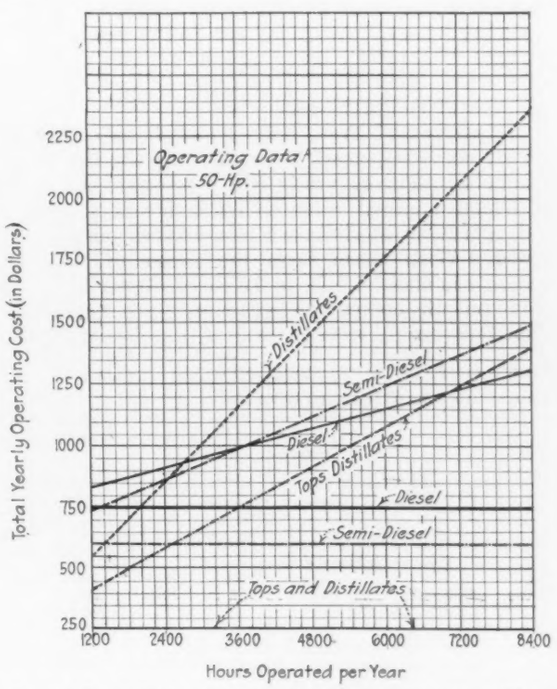
The curves in Figs. 1, 2, 3 and 4 permit a comparison of the total annual expense of operating various types of oil engines at full load for different lengths of time per year. These curves are based on interest at 6 per cent, taxes and insurance at 1 per cent, repairs at 3 per cent, depreciation at 10 per cent, and fuels and engines at the prices given in Table I. No allowance has been made for labor. These data might be made somewhat more accurate by assuming repair and depreciation percentages according to operating conditions, which are practically zero with no operation and increase in direct proportion to the horsepower-hours operated. If this had been done, all of the curves would have had a slightly increased slope. One thing which should be remembered in studying these curves is that their relative positions will change with relative changes in the cost of oil fuels and engines.

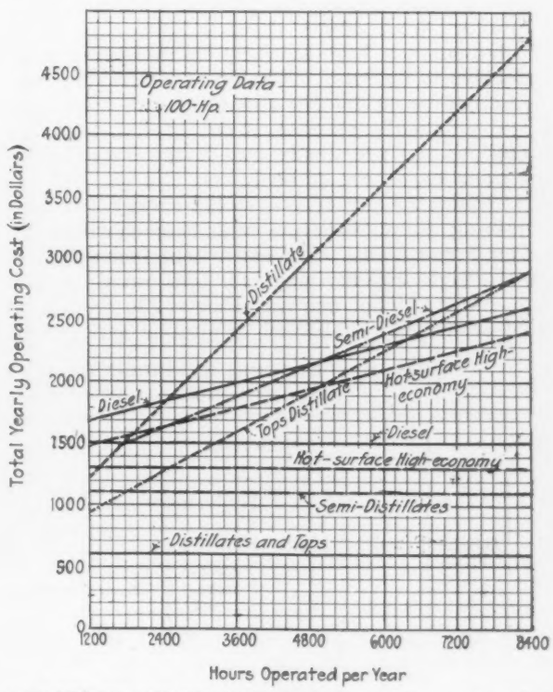
The horizontal lines have been added to each set of curves to facilitate estimating the total operating cost when the average load on a machine is less than the rated full load. To make such an estimate the procedure

TABLE I—PRICES AND DATA ON FUEL OILS AND ENGINES

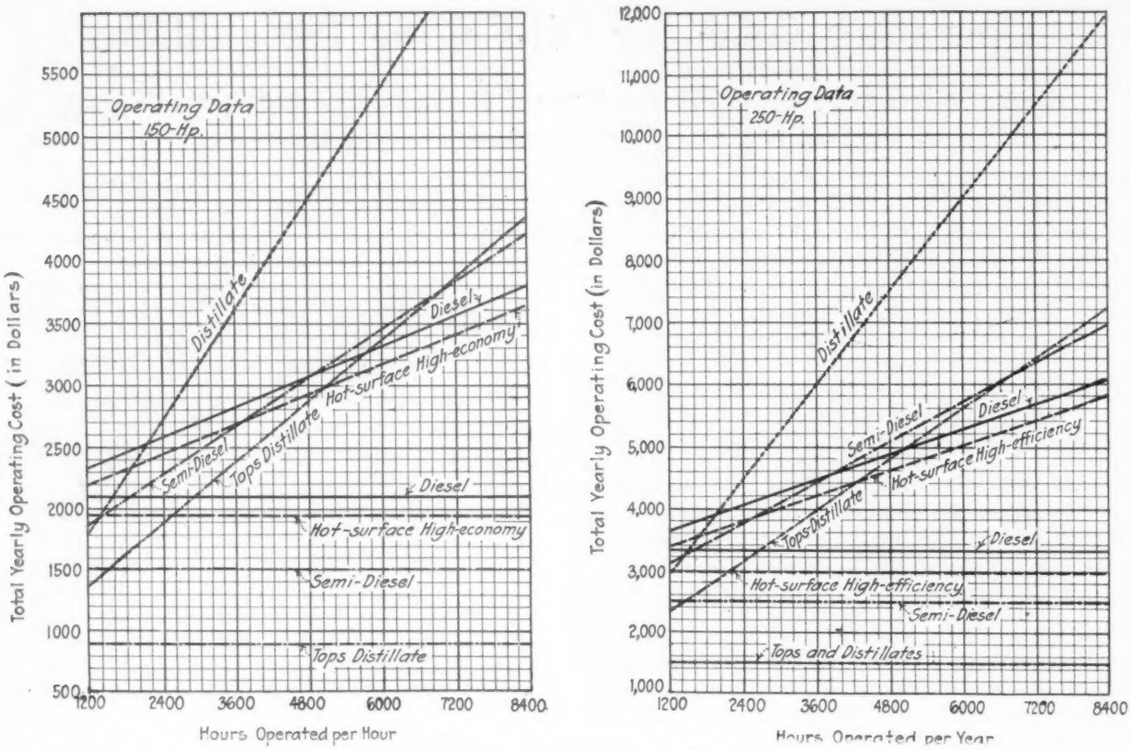
Type of Engine	Specific Gravity of Oil (Deg. Baumé)	Approximate Price of Oil per Gal. (Cents)	Thermal Efficiency at Full Load	Brake-hp.-hr. per Gal. of Fuel	Approximate Cost of Engines per Brake-hp.			
					Horsepower			
					50	100	150	250
Distillates	48–51	5	20	10	$25	$30	$30	$30
Tops-distillates	38–42	2.75	20	10	25	30	30	30
Semi-Diesel	24–28	2.143	18	10	60	55	50	50
Hot-surface, high-efficiency	16	2.143	27	16	..	65	65	60
Diesel	18	2.143	28.4	16	75	75	70	65

is as follows: Measure the ordinate corresponding to the hours the machine is operated between the inclined and horizontal line for the particular engine and by laying off an equal distance on the scale at the left obtain the number of dollars representing the cost of fuel which would be required with the engine operating at full load. Then multiply this amount by the average percentage of rated load carried and also by the ratio of the fuel economy at the particular load to the economy





FIGS. 1 AND 2—TOTAL ANNUAL COST OF OPERATING 50-HP. AND 100-HP. OIL ENGINES AT FULL LOAD: THE HORIZONTAL LINES INDICATE THE FIXED CHARGES ON EACH TYPE OF EQUIPMENT



FIGS. 3 AND 4—TOTAL ANNUAL COST OF OPERATING OIL ENGINES AT FULL LOAD. THE HORIZONTAL LINES INDICATE THE FIXED CHARGES ON EACH TYPE OF EQUIPMENT

at full load. By adding the result so obtained to the ordinate of the fixed-charge line the approximate yearly operating cost at that average load will be obtained.

This arrangement of curves also permits a comparison of fuel costs for different engines and periods of operation. It is interesting to note that 50-hp. tops-distillates engines are cheaper to operate than any of the other types of the same rating up to 7200 hours a year. In 100-hp. sizes hot-surface, high-economy engines are cheapest to operate when used more than 5000 hours a year. Below this tops-distillates engines show an advantage. With higher rated engines tops-distillates and hot-surface, high-economy engines remain the least expensive to operate, the point at which it is best to change from one to another changing with the rating needed. In practically all cases it can be seen that distillates engines are practically out of the question because of their high cost of operation.

Table II shows the cost of generating energy in a New Mexico mining plant which is operating continuously twenty-four hours a day. The equipment includes four hot-surface, high-economy engines, two rated at 180 brake-hp., one at 250 hp., and the other at 280 hp. These are belted or directly connected to electric generators. The engines are operating at an altitude of 7000 ft. and are 90 miles from a railroad station. The cost of hauling over this distance is about 1 cent per pound, which accounts for the high price of fuel and lubricant. If fuel oil could have been obtained at 2 1/7 cents per gallon and lubricant at 35 cents per 1000 hp.-hr., the equivalent cost of operating this plant would have been $45.70 per horsepower-year at the engines and $74.50 per kilowatt-year at the switchboard, instead of $136.51 per horsepower-year and $164.41 per kilowatt-year, with fuel oil at 16.5 cents per gallon and lubricant at 71 cents per 1000 hp.-hr. These figures do not include the fixed charges of interest, taxes and insurance, and depreciation, which may amount to from 17 to 20 per cent of the cost of the machines.

The curves of Figs. 1, 2, 3 and 4 indicating Diesel-engine operating costs were based on the use of 18-deg. Baumé oil. The curves in Fig. 6 compare the economies of Diesel engines when using different grades of oil and operating at different percentages of rated horsepower. With these fuels the range of the full-load economy is about 0.4 lb. to 0.5 lb. of oil per brake-hp.-hr.

To permit comparing expenses in a turbine-driven plant burning oil with those in a Diesel-engine plant the

TABLE II—OPERATING EXPENSES IN A NEW MEXICO HOT-SURFACE OIL-ENGINE PLANT

Based on 8640 hours per year, with fuel at 16.5 cents per gallon and lubricating oil 71 cents per 1000 hp.-hr.

Estimated Output		Oil Consumed				Cost of Operation							
				Lb. per		Labor		Materials and Supplies					Total Cost
At Switchboard, Kw.-hr.	At Engines Hp.-hr.	Gal.	Lb.	Kw.-hr. Switchboard	Hp.-hr. Engines	Operating	Maintenance	Fuel Oil, 16½ Cents Gal.	Lubricating Oil, 71 Cents per 1000 Hp.-hr.	Repair Parts	Belts	Miscellaneous Supplies	
2,469,293	3,996,196	278,595	2,061,602	0.84	0.52	$7907.31	$2211.76	$46,603.62	$2838.82	$1659.50	$1792.92	$1044.64	$64,052.57
Per kw.-hr.		0.113	0.835			0.0032	0.0009	0.0189	0.0011	0.0007	0.0007	0.0004	0.0259
Per hp.-hr.		0.083	0.516			0.0019	0.0006	0.0116	0.0007	0.0004	0.0005	0.0003	0.0260

TABLE III—RELATION OF ITEMS OF EXPENSE TO TOTAL OPERATING COSTS

Item	Proportion of Total Operating Expense (in per Cent)	
	Under Actual Conditions (Oil at 16.5 Cents per Gal. and Lubricant at 71 Cents per 1000 Brake-hp.-hr.)	With Oil at 2 1-7 Cents per Gal. and Lubricant at 35 Cents per 1000 Brake-hp.-hr.
Operating labor	12	36
Maintenance labor	3	10
Fuel	73	27
Lubricant	4	6
Repair parts	3	8
Belt renewals	3	8
Miscellaneous supplies	2	5

curves in Fig. 5 and Table IV are presented. The plants are imaginary, but the cost figures can be considered approximately correct. The table seems to show that a Diesel-engine plant may enter into serious competition with steam plants when the load-factor is better than 25 per cent. The curves show the effect of the price of oil on the operating cost. When the price of oil is about 53 cents a barrel the yearly cost will be the same for both plants. Above this price the Diesel plant has the advantage. In the turbine plant the fuel expense is the largest single item, whereas in the Diesel plant fixed charges constitute the largest single expense. It is difficult to make any definite conclusions, as the life of Diesel engines is still open to discussion.

By analyzing the data in Table II it is found that the relation each of the items of expense bears to the total operating cost is as shown in the first column of Table III, whereas if fuel oil and lubricant could have been obtained without considerable haulage—say at 2 1/7 cents per gallon and 35 cents per 1000 brake-hp.-hr. respectively—the relations would be as shown in the second column.

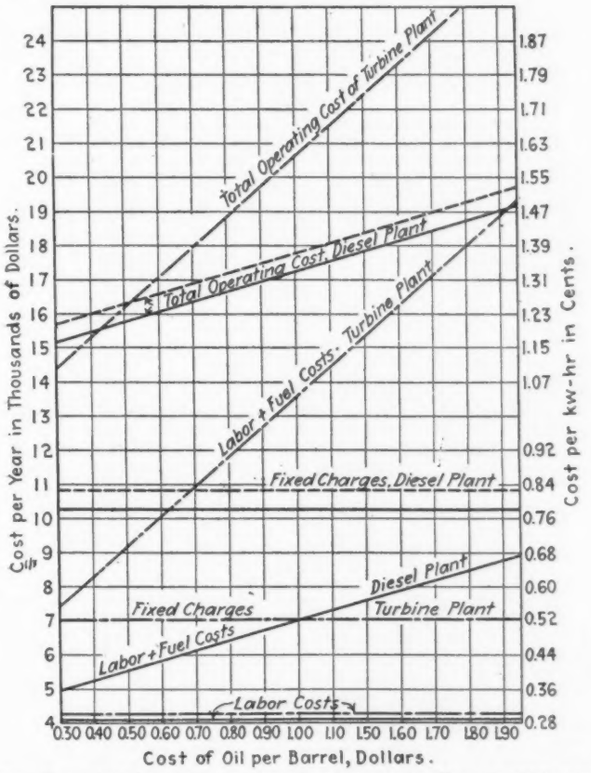

Cost per Year in Thousands of Dollars.
Cost per kw-hr in Cents.
Total Operating Cost of Turbine Plant
Total Operating Cost, Diesel Plant
Labor + Fuel Costs, Turbine Plant
Fixed Charges, Diesel Plant
Diesel Plant
Turbine Plant
Fixed Charges
Labor + Fuel Costs
Labor Costs
Cost of Oil per Barrel, Dollars.

FIG. 5—COMPARISON OF OPERATING EXPENSES OF 600-KW. STEAM TURBINE AND DIESEL-ENGINE PLANTS

TABLE IV—COMPARISON COSTS, STEAM TURBINE AND DIESEL ENGINE, 600 KW. POWER PLANT

Assumptions: Load-factor, 25 per cent; maximum load equal to rated output. (This gives turbines slight advantage in overload capacity.) Turbines operated condensing, using jet condenser and cooling tower. Oil fuel. Crude oil, 95 cents per barrel; distilled oil, $1.50 per barrel. Turbine plant develops 140 kw.-hr. per barrel. Diesel plant develops 447 kw.-hr. per barrel.

First Cost

Turbine Plant		Diesel-Engine Plant		
One 200-Kw., One 400-Kw. Unit		Three 200-Kw. Units		One 200-Kw., One 400-Kw. Unit
Boilers and settings	$6,200	Engines	$51,000	$47,500
Pumps	250	Erecting	5,000	5,000
Piping	500	Piping	1,400	1,400
Stack and flues	2,950	Oil tanks	1,000	1,000
Heaters	500	Water-cooling apparatus	1,000	1,000
Turbines	12,500	Generators	11,400	11,400
Generators, etc.	11,400	Building	6,000	6,000
Condensers	2,400			
Cooling tower	3,500			
Building	10,000			
Total	$50,200	Total	$76,800	$73,300

Operating Costs (1,314,000 Kw.-hr. per Year)

Turbine Plant		Diesel-Engine Plant			
Wages	$3,000	Wages	$3,000		
Lubrication	500	Lubrication	500		
Miscellaneous	100	Miscellaneous	100		
Maintenance	400	Maintenance	400		
Water	250	Water	50		
	$4,250		$4,050		
		Three Engines		Two Engines	
Fuel, 95 cents bbl.	$8,910				
Fixed charges 14 per cent.	7,030	95 Cents Bbl.	$1.50 Bbl.	95 Cents Bbl.	$1.50 Bbl.
Total	$20,190	Fuel	$2,790	$4,410	$2,790	$4,410
		Fixed charges, 14 per cent.	10,780	10,780	10,280	10,280
		Total	$17,620	$19,240	$17,120	$18,740

In this comparison interest was assumed at 6 per cent, depreciation at 6 per cent, and insurance and taxes at 2 per cent for both plants. The items of first cost are only approximately correct; the output per barrel of oil is based on reports from both Diesel and steam plants (the steam plant is in California and the oil-engine plant in Texas); the cost of distilled oil was purposely placed high to be fair to turbines; and operating expenses were based on reports from the above-mentioned plants.

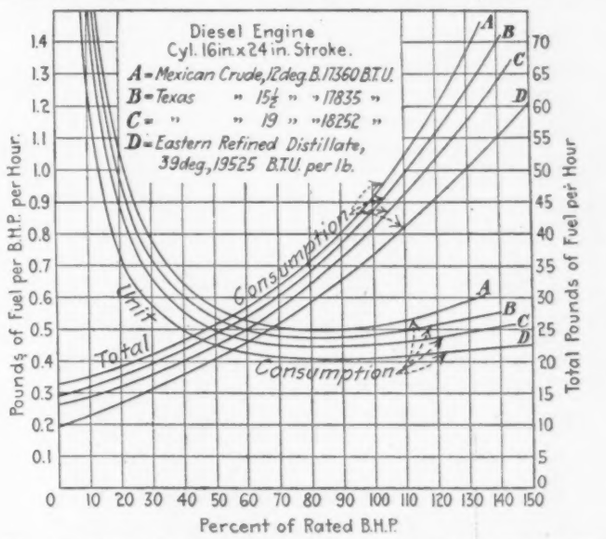

Diesel Engine
Cyl. 16in. x 24 in. Stroke.
A = Mexican Crude, 12deg. B. 17360 B.T.U.
B = Texas " 15½ " " 17835 "
C = " " 19 " " 18252 "
D = Eastern Refined Distillate, 39deg., 19525 B.T.U. per lb.
Pounds of Fuel per B.H.P. per Hour.
Total Pounds of Fuel per Hour
Unit Consumption
Total Consumption
Percent of Rated B.H.P.

FIG. 6—UNIT AND TOTAL FUEL CONSUMPTIONS FOR DIESEL ENGINES AT DIFFERENT PERCENTAGES OF RATED LOAD

COSTS ON COOLING-POND CONSTRUCTION

Installation and Operating Data for Different Types of Ponds Where Water Is Sprayed

The accompanying tables give data on the operation and cost of constructing cooling ponds equipped with spray nozzles for cooling the circulating water of condensers used with steam engines and turbines. In order to make a proper comparison of the costs of cooling arrangements for prime movers varying in rating from 500 kw. to 2000 kw. it is necessary to assume a steam consumption that is fairly consistent with plant practice in each case. For the 500-kw. turbo-generator a steam consumption of 22 lb. per kilowatt-hour, when operating at a 27.5-in. vacuum referred to a 30-in. barometer, is taken as an average water rate for summer weather in the Middle and Southern States, or a total steam consumption of 11,000 lb. per hour for the unit. In order to obtain the vacuum mentioned, it is necessary to have a ratio of circulating water to steam of sixty to one, therefore 1320 gal. per minute of water will be circulated and sprayed at the cooling pond. This will require about thirty-five nozzles of a size to discharge approximately 40 gal. per minute at 7 lb. pressure at the nozzle. The cost of such an equipment of nozzles, spray heads, spray arms, drip sprays and piping, including eccentric spray, tees, valves when required, suction-well wall piece and flange-by-bell elbow, is about $825, as shown in Table II.

The size of the pond required for a 500-kw. installation should be about 50 ft. by 128 ft. with the sprays arranged in seven groups of five nozzles each, connected to a pipe line down the center of the pond. If a concrete basin is required, it should have a 5-in. reinforced concrete bottom and side walls, the side walls having a slope of two to one to avoid the cost of forms. In this case the pond should have a suitable suction well with double screens to prevent the nozzles from clogging and also piers carrying plates and rolls on which the piping can rest. The total construction cost for such a pond, including the excavation, will be about 40 cents per sq. ft. under average conditions with no hazards, or a total of $2,560 for the concrete basin complete. This amount added to the cost of the special equipment and piping makes the total approximate cost for the 500-kw. installation $3,385.

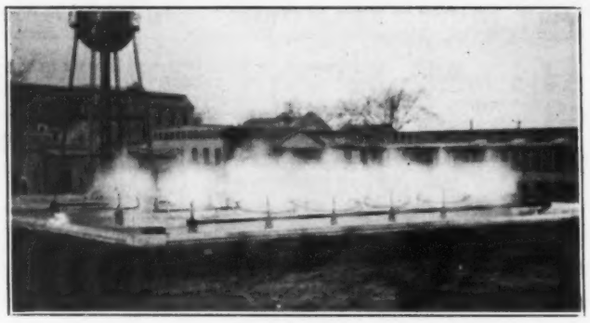


FIG. 1—CONCRETE SPRAY COOLING POND FOR A 500-KW. MASSACHUSETTS STATION

If the conditions are such that a pond can be constructed with a 6-in. puddled clay bottom and the bank lined with puddled clay of the same thickness, the cost would be about 20 cents per square foot, or $1,280 for the basin complete. Adding the cost of the special equipment and piping to this amount, the total cost of a pond of this character would be about $2,105.

On a similar basis for the 1000-kw. unit, assuming a steam consumption of 20 lb. per kilowatt-hour, a ratio of circulating water to steam condensed of sixty to one, and the same size of nozzles as before spraying 2400 gal. per minute, sixty nozzles would be required. The cost of this equipment, with the necessary piping, fittings and the like, would be around $1,585. This installation would require a pond 90 ft. by 90 ft. or 65 ft. by 125 ft., with an arrangement of three or two lines of pipe having four or six groups of sprays of five nozzles each per line. The cost of a concrete basin of these dimensions at 40 cents per square foot would be $3,240 and, including special equipment and piping, $4,825. For a pond with puddled clay bottom and sides the total cost would be $3,205. The costs for the 2000-kw. installation shown in Table I are arrived at in the same manner, assuming a steam consumption of 18 lb. per kilowatt-hour.

In Fig. 1 a concrete basin for a 500-kw. installation is

TABLE I—OPERATING DATA FOR SPRAY COOLING SYSTEMS USED WITH PLANTS OF VARIOUS RATINGS

Location of plant	Mass.	N. J.	N. J.	N. J.	Md.	Pa.	S. C.	Tex.	Tex.
Rating of engines or turbines, in kw	500*	550	1200	125	¶	14,250	2600	1500	300
Type of condenser	Surface	Jet	Surface	.....	¶	Jet	Jet	Surface	Jet
Operating vacuum	28.5	27.5	28.0	28.0	¶	29.0	25.0	28.5	27.0
Gallons water per minute to condenser	1610	2000	3200	150	850	10,000	4000	3700	866
Rating of spray system, gallons per minute	2880	2000	8000	660	1600	7920	4500	3840	800
Number of nozzles	72	50	200	20	40	132	75	96	20
Temperature of water leaving condenser, deg. Fahr	90	100	100	115	182	99	130	105	110
Temperature of water in cooling pond, deg. Fahr	75	88	90	89	100	82	100	96	94
Average air temperature during summer, deg. Fahr	71.3	72.5	72.5	72.5	77.3	71.8	77.8	80.5	83.0
Relative humidity during summer, deg. Fahr	70.0	84.0	84.0	84.0	70.0	68.0	69.0	76.0	51.0
Pond area in square feet	9240	2500	14,000	4800	3500	360,000	40,000	10,000	2000
Capacity of pond in thousand gallons	230	100	350	72	80	14,889	1800	300	.....
Number of times water is sprayed	1	1	1	1	2	1	1	1	1
Source of water supply	Well	Mine	Well	Well	Well	Well	River	River	Well
Cost of water per 1000 gallons in cents	0.0	0.0	1.5	0.0	1.5	3.0	0.0	0.0	0.0
Pumping charge per hour in kw.-hr	10.0	40.0	40.0	10.0	22	250	60	.....	10
Approximate cost of cooling system	$700	$8000†	$10,000‡	$1000	$7500	.....	$4000	$3000§	$1800

*Low-pressure turbine. †Special equipment. ‡Pond and spray capacity for double the load. ¶Cooling system for gas engine. §Natural pond.

TABLE II—COST OF CONSTRUCTING COOLING PONDS WITH SPRAY NOZZLE EQUIPMENT

Size of Steam Unit, Kw.	Assumed Steam Consumption Lb. per Kw.-hr.	Total Steam Condensed per Hour, Lbs.	Circulating Water Required, 60 to 1 Ratio, G.p.M.	Number of Nozzles Required	Cost of Nozzles, Equipment and Piping Complete	Size of Cooling Pond Required, Ft.	Approximate Cost Concrete Basin Complete	Approximate Cost Puddled Clay Basin Complete	Approximate Cost Concrete Basin, Equipment and Piping Complete	Approximate Cost Puddled Clay Basin, Equipment and Piping Complete
500	22	11,000	1320	35	$825	50x128	$2560	$1280	$3385	$2105
1000	20	20,000	2400	60	1585	90x 90	3240	1620	4825	3205
2000	18	36,000	4320	110	2310	112x120	5400	2700	7710	5010

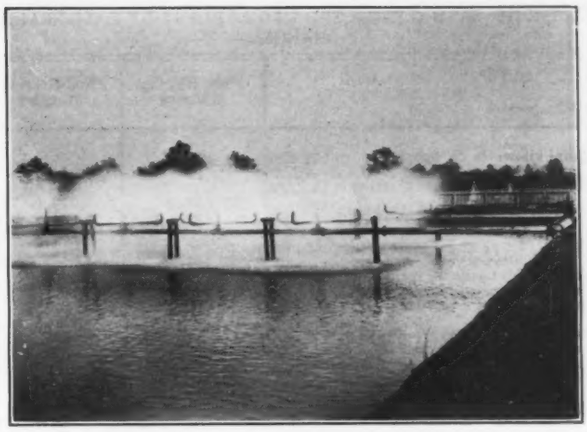


FIG. 2—PUDDLED-CLAY-BOTTOM SPRAY COOLING POND FOR 1000-KW. SOUTH CAROLINA STATION

shown, and in Fig. 2 a basin with a puddled clay bottom and sides for a 1000-kw. installation. The illustration in Fig. 3 shows the basin and spray system used for cooling the circulating water of gas-driven blowing engines at a steel plant. The performance of the equipment in Fig. 1 is shown in the first column of Table I, and the performance of the installation in Fig. 3 is shown in column 5 of the same table. The data in Table I have been furnished by plants operating spray ponds, and the costs given in most cases represent the total investment in the cooling equipment, including pumps.

In a discussion on cooling systems at a recent meeting of cotton manufacturers at New London, Conn., Lee H. Parker of Boston, Mass., described various spray-cooling systems and explained how in one case a mountain stream in the South was used as a cooling pond for a cotton-mill plant. Owing to high water in the spring and to avoid placing supports for the piping in the stream, the piping and nozzles were placed on each side of it and the water was sprayed into a pond created, at an angle of 60 deg. from the horizontal. Tests referred to at this meeting seemed to show that the average amount of heat dissipated from the surface of a natural cooling pond with partitions is about 3.5 B.t.u. per square foot per hour per degree of difference of temperature, and that the average heat dissipated by a spray cooling pond is 127 B.t.u. per square foot per degree of difference per hour. This means that a cooling pond without sprays capable of caring for a 100-hp. plant may be increased in capacity to handle a 3600-hp. plant by the use of spray cooling. With cooling ponds of any type the feed water may be taken from the pipe line between the condenser and the pond to save heat units.

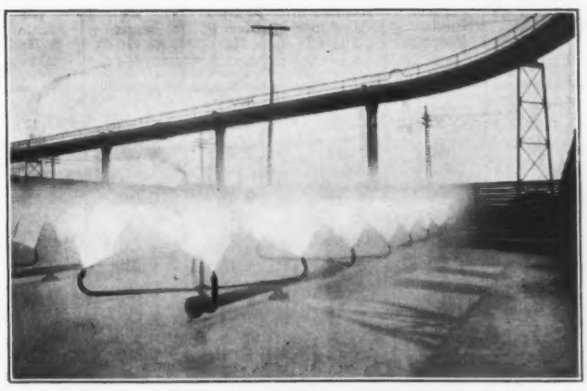


FIG. 3—COOLING POND AND SPRAY SYSTEM INSTALLED ON ROOF OF MARYLAND STATION

THE FRICTION LOAD OF SHAFT BEARINGS

Power Represented by Friction of Different Bearings and Motor-Drive Arrangements

The results of various tests on line shafts and countershafts in mills and factories equipped with plain babbitt bearings, roller bearings and ball bearings have shown that a considerable amount of electrical energy can be saved, where the shafts are driven by motors, through a proper selection of the bearings and arrangement of the drives. The friction load of many line-shaft installations is larger than it should be, and in such cases there is ample opportunity for an analysis of the losses due to friction and a balancing of this against the cost of more economical bearings. From tests* by Prof. Carl C. Thomas made at the University of Wisconsin some interesting performances of different kinds of bearings were formulated, as shown in Figs. 1 and 2. The losses due to increase of load on

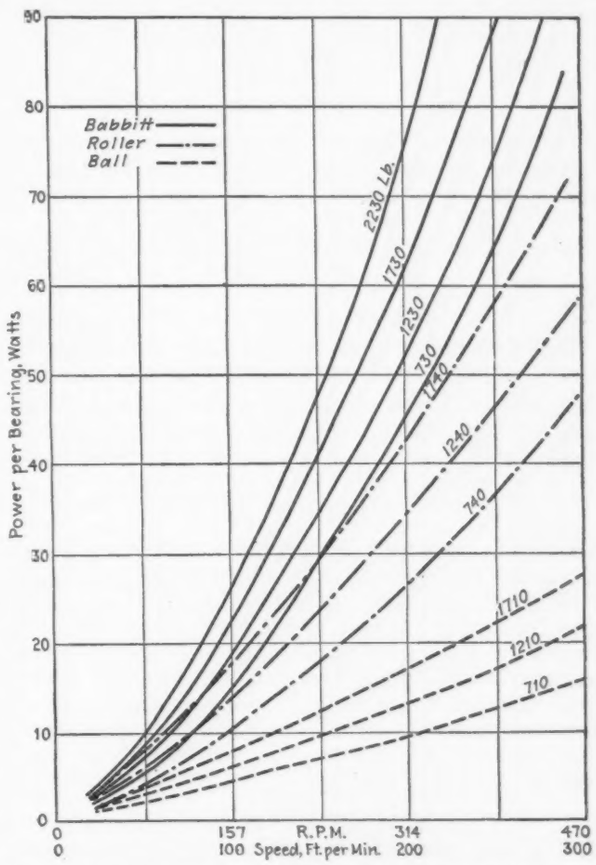


FIG. 1—POWER CONSUMED BY FRICTION OF BEARINGS WITH DIFFERENT LOADS AND SPEEDS; TEMPERATURE, 77 DEG. FAHR.

bearings of different types with increase of speed and different operating temperatures are clearly shown. While shafting is running idle the power consumption of plain and ball bearings may differ but slightly. As the load increases, however, the power consumption of the plain bearing increases at a much greater rate, as shown in Figs. 1 and 2. The excess of the power required by babbitt over roller and of roller over ball bearings increases with an increase of speed for all loads. The relative amounts of power as determined by Professor Thomas consumed in friction by the different kinds of bearings are shown in Table I on page 810.

*Presented before the American Society of Mechanical Engineers in 1913.

The data in Table II show the friction load due to shaft bearings and belt drives in the punch-press, screw-machine, drilling and tapping, milling and profiling, rough-store, tool-room, polishing and buffing, and initial-assembly departments of a new manufacturing plant in Indiana. The machines driven handle a product which weighs less than 10 lb., so that the friction losses are an important consideration in the total energy demand. The shafting is supported in ball-and-socket, two-point, double-arm, ring-oiled, 24-in. drop hangers.

The data given in Table II were obtained from readings of a recording watt-hour meter, with all of the belts up to idle pulleys left running during the test. The results indicate that belting back from a main-line shaft to a sub-shaft increases friction losses and that it is better to install separate motors to drive such sub-shafts. It is also apparent that the number of bearings and the speed of the shaft have but little effect on the friction losses. Liquid grease costing 10 cents per lb. or $40 per bbl. was found satisfactory for all line-shaft and countershaft bearings and loose pulleys except those running at very high speeds.

Determination of Saving Possible

The curves of Fig. 2 have been plotted to show the reduction of power consumed by ball bearings over ordinary bearings of the sleeve type. The data from which the curves were plotted were secured by using a motor under the same conditions to drive a long shaft equipped first with ring-oiled babbitt bearings and second with ball bearings. Readings were taken of the energy consumed by the motor under varying loads and speeds. As an illustration in the use of these curves, take the case of a shaft operating at 300 r.p.m. with ordinary bearings under an average load of 840 lb. per bearing. By following the ordinate 300 r.p.m. to curve *B* the reduction of power consumed by friction is about 64 per

TABLE I—RELATIVE AMOUNTS OF POWER CONSUMED IN BEARING FRICTION

Bearing	100 Ft. per Minute		300 Ft. per Minute	
	77 Deg. Fahr.	100 Deg. Fahr.	77 Deg. Fahr.	100 Deg. Fahr.
Babbitt	3.0	3.6	4.5	4.0
Roller	2.2	2.5	2.7	3.0
Ball	1.0	1.0	1.0	1.0

TABLE III—SAVING EFFECTED IN ONE PLANT BY BALL-BEARING HANGERS

	Plain-Bearing Hangers	Ball-Bearing Hangers
Total kilowatts to operate machines and shafting	93	74.6
Horsepower to operate shafting with belts on loose pulleys	32	13.5
Number of bearings	110	110
Cost of energy at 1.5 cents per kw.-hr., for 3150 hours per year	$4,394.25	$3,524.85
Cost of ball bearings, including erection	.....	$1,208.00
Interest on investment at 6 per cent	.....	$72.48
Depreciation at 4 per cent	.....	$48.32
Total cost first year	.....	$1,328.80
Saving in energy required	.....	$869.40
Saving in maintenance and lubrication	.....	$125.75
Total annual saving due to hangers	.....	$995.15
Return on investment after sixteen months, in per cent	.....	75.0

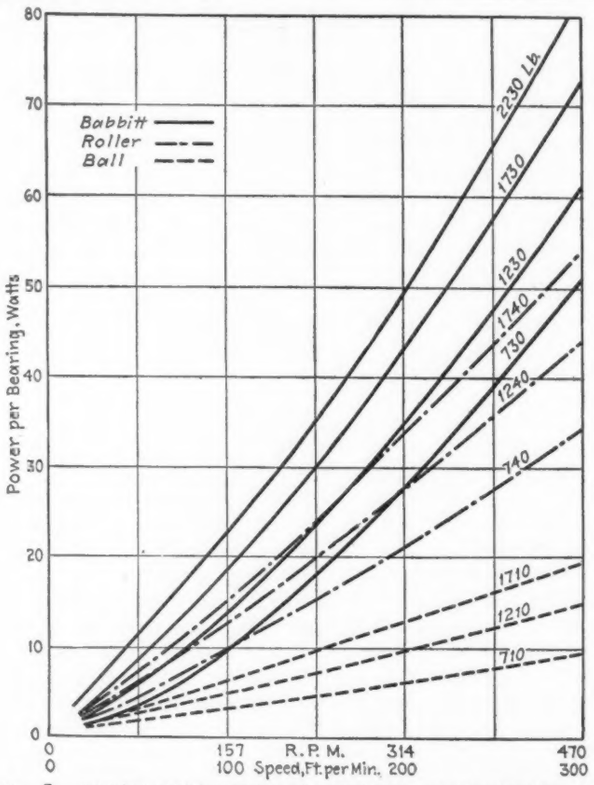


FIG. 2—POWER CONSUMED BY FRICTION OF BEARINGS AT DIFFERENT LOADS AND SPEEDS; TEMP., 100 DEG. FAHR.

TABLE II—LINE-SHAFT FRICTION LOAD IN A MANUFACTURING PLANT AS SHOWN BY TESTS

Department	Line Shafts					Number of Countershaft Bearings	Total Number of Bearings	Number of Machines Driven	Friction Load in Hp.	Friction per Bearing in Hp.*	Friction per Machine in Hp.†
	No.	Length in Feet	Diameter, Inches	Speed, R.p.m.	Number of Hangers						
Punch press	1	160	2.6875	150	16	4	32	20	3.42	0.107	0.171
	2	120	2.1875	150	12						
Screw machine	1	150	2.6875	200	15	36	90	29	6.83	0.076	0.235
	2	170	2.6875	200	17	22					
Drilling and tapping	1	80	2.1875	200	8	18	49	17	2.28	0.046	0.134
	2	70	2.1875	200	7	16					
Tool room	1	90	2.4375	200	9	34	46	17	3.42	0.075	0.201
	2	20	2.1875	200	3	..	..	..	....	.....	.....
	3	90	2.4375	200	9	30	39	15	1.14	0.029	0.076
Milling and profiling	1	100	2.4375	200	10	20	30	10	2.28	0.076	0.228
	2	100	2.4375	200	10	22	32	11	3.42	0.107	0.311
Rough-store	1	20	2.1875	150	3	2	5	3	1.17	0.234	0.390
Polishing and buffing	1	60	2.4375	300	7	4‡	19§	9	10.25	0.540	1.140
Initial assembly	1	70	2.1875	200	8	24	32	12	1.51	0.063	0.125

In the punch-press, screw-machine and drilling and tapping departments a motor is belted to No. 1 shaft, which belts back to shaft No. 2. In the milling and profiling, rough-store, polishing and buffing and initial-assembly departments a motor is belted to each line shaft. In the tool room the motor is belted to shaft No. 1, which is a main shaft, and back to shaft No. 2, which is a sub-shaft. Shaft No. 3 is driven by another motor.

*Includes belt losses. †Includes all losses. ‡A 30-in. exhaust fan was running under load during test. §Includes six loose pulleys and two fan bearings.

cent. In cases where the friction of ordinary bearings runs high, from 20 to 40 per cent of the total energy consumed, the saving due to the ball-bearing shaft hangers has ranged from 12 to 24 per cent of the cost of energy, depending upon the character of drive and

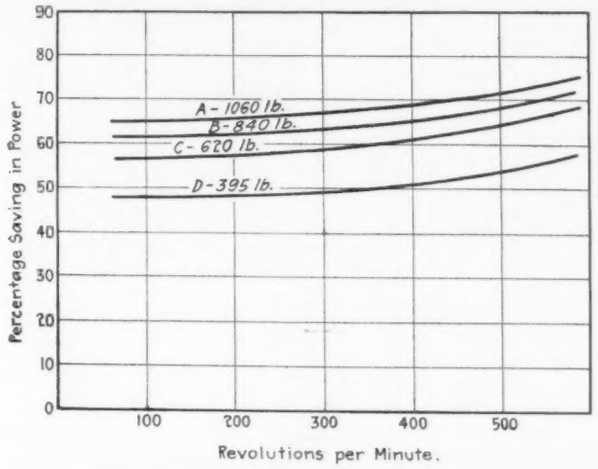


FIG. 3—RELATIVE REDUCTION IN POWER CONSUMED BY FRICTION FOR BALL BEARINGS AS COMPARED WITH BABBITT BEARINGS

the way the shafts were loaded. The bearing pressures for the tests referred to with reference to the projected area for babbitt bearings were about 30 lb. to 100 lb. per square inch at speeds above and below normal practice of 200 r.p.m.

Sound Effects When Using an Exploring Coil to Locate Cable Faults

In using the exploring-coil method of finding faults explained in the articles of the Sept. 11 and 18 issues of the ELECTRICAL WORLD the location of a fault is generally determined by the difference in sound on either side of the break. In nearly all cases there will be some sound beyond the fault, but the difference is generally marked, and at any abrupt change in sound the tester looks closely for trouble. Bonds between cables are sometimes a help and sometimes a hindrance in fault location. The general practice is to listen on the bonds, if there are any in the manholes, as they may help the trouble hunter in his decision. Thus, on street circuits where the loop is bonded and the trouble is quite near the station owing to the returning of the testing current on its own sheath, the sound is often considerably lessened by neutralization, and it is not so loud as would be expected up to the fault. Absolute proof is obtained by taking off a small strip of lead from both legs on the station side of the bond and noting the sound difference.

In case of short-circuit, the sound is alike from station to fault, the sheath current being eliminated and the only possible false sound beyond the fault being due to charging or condenser effect. With the short-circuit connection the sound in the longitudinal coil is always louder than with the ground connection, maximum sound being obtained every 10 in. (the length of the coil), while in case of ground the maximum sound occurs every 20 in. In three-phase, three-conductor cables the sound is generally not so loud as with single-conductor cables. Listening with the triangle against street-railway tracks running parallel with cables is often sufficient to trace a fault, and the sound from the Edison tube system is nearly always very loud.

Operating Schemes

Two dollars will be paid for each item published giving ideas and data, new or simplified methods and experiences in solving troubles.

A Simple Scheme for Dead-Ending a Crane Trolley Wire

The accompanying illustration shows a convenient and serviceable way of dead-ending a traveling-crane trolley wire. For a No. 2/0 copper wire a 0.75-in. punched wrought-iron bolt washer may be used, and for other sizes reference to a wire table will show the size

PLAIN WASHER USED TO GRIP TROLLEY WIRE AT DEAD END

of washer required to fit over twice the diameter of the wire used. The fiber tube shown is used as a safety stop. It should be long enough so that the crane trolley will be lifted off the wire a sufficient distance from the end of the crane travel to prevent an accident in case of emergency.

A Way of Lighting a Tailrace Gage to Facilitate Night Readings

At the Turners Falls (Mass.) hydroelectric plant of the Turners Falls Power & Electric Company the tailrace gage shown in the accompanying illustration is fixed in a vertical position by bolts and braces sunk in the station wall. Since the height of water in the tail-

REFLECTOR AND LAMP FOR READING TAILRACE GAGE, SHOWN JUST ABOVE WATER

race varies considerably and since night readings are required, a screened drop light is used with a conical reflector cut away sufficiently to enable the water level to be checked easily against the gage. The lamp is raised and lowered from the station window, and the gage is read from a small iron platform overhanging the tailrace.

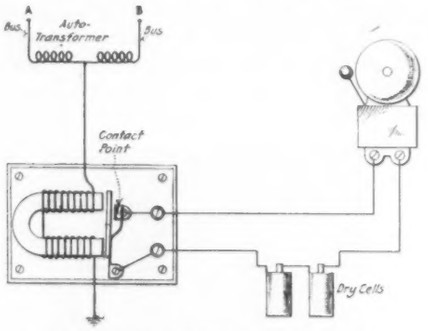
Remodeling Old Meters to Keep Pace with Improvements in New

For years the Metropolitan Electric Company, Reading, Pa., has been using 110-volt Thomson type M watthour meters on both alternating-current and direct-current circuits. When 10-watt lamps were introduced, however, it was found that they would not record accurately on light loads. Several changes were therefore made in all of the instruments, with the result that they now operate as accurately as the recent models and are more rugged than some types.

The changes made are as follows: The commutators, spring brushes, copper disks, steel pivots and low-torque armatures were removed. New ⅛-in. commutators with filled-in segments were made and placed on the shafts with armatures weighing slightly more than those in the Thomson type C-6. Gravity brushes were employed and aluminum disks and sapphire pivots substituted for those formerly used. The field coils were reinsulated, and on the three-wire meters different devices were provided for holding the adjustable compensating coils. When the alternating-current meters are removed from a location they are subjected to a 2200-volt break-down test to detect faults in insulation.

An Alarm Arrangement Designed for the Purpose of Indicating Grounds

A simple alarm arrangement to indicate grounds is shown in the accompanying sketch. The electromagnet is wound with No. 6 B. & S. copper wire and requires little energy to energize it and make the connection at the contact point to sound the gong. In a quiet



CIRCUITS FOR GROUND-WIRE ALARM

station a small vibrating bell with a gong of high pitch will serve as a signal, and in this case batteries as shown may be used. In a noisy station it may be advisable to install a larger gong operated from a bell-ringing transformer connected to the low-voltage station or lighting circuits.

Protecting Linemen When Using Telephone Circuits Paralleling Transmission Lines

When telephone circuits and high-voltage lines are supported on the same structure, care must be taken to protect operators from dangerous voltages when telephoning. After considerable experimenting the San Joaquin (Cal.) Light & Power Corporation has adopted the method of protection shown in Fig. 1, which protects the telephone instrument as well. Across telephone branch lines leading to instrument terminals bleeder transformers are connected with the middle points permanently grounded. These afford a metallic path to ground for induced and foreign voltages and still offer sufficient resistance to the high-frequency ringing and talking currents. For additional protection 36-in., 0.5-amp. porcelain-inclosed fuses are connected in series with the branch circuits on the instrument side of the bleeder transformers. Between these and the telephones are weatherproof spark-gaps, the center points of which are substantially grounded. The gaps

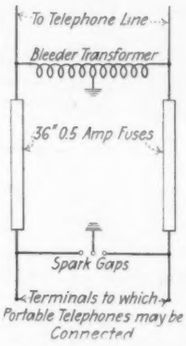


FIG. 1—PROTECTIVE ARRANGEMENTS USED WITH TELEPHONE SET

are set 1/32 in. to 1/16 in. apart. These devices will ground high voltages and blow the fuses, thereby interposing 36-in. gaps between the line and instrument terminals. The fuse blocks are supported on high-voltage insulators and the fuses are handled with 6-ft. shellacked sticks.

Portable telephones are employed on these lines, and electrically connected to the branch-line terminals by spring-clips which are handled with 4-ft. shellacked sticks. In order that the telephones need not be touched while being used, they are attached to the poles about 9 ft. above the ground by straps. Portable insulating platforms are provided which can be attached to the poles about 2 ft. above the ground. The side of the platform adjoining the pole is curved to fit, and straps are used to buckle it thereto and support the outer end, as shown in Fig. 2.

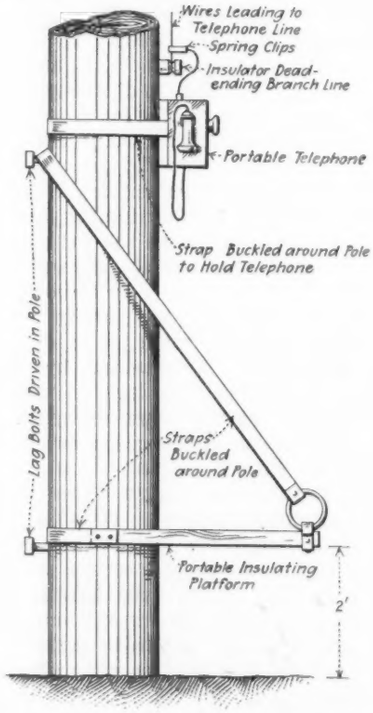
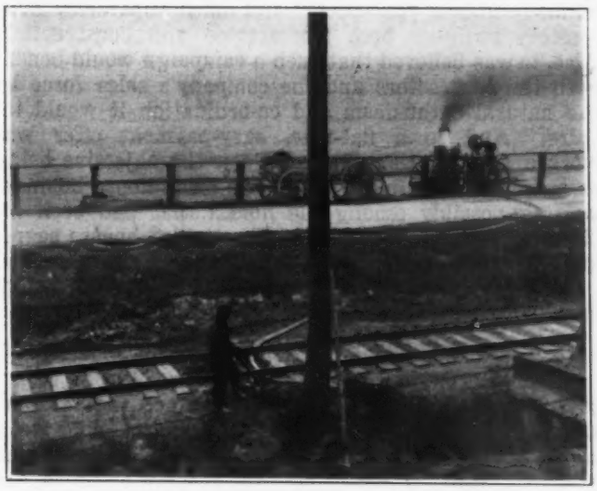


FIG. 2—SHOWING PORTABLE PLATFORM AND TELEPHONE READY FOR USE

Setting Poles by Use of a Water Jet Furnished by Fire Engine

In the accompanying illustration a method of setting poles is shown where trouble is encountered due to quicksand. In this case a 1.5-in. jet of water from a fire hose connected to a steam fire engine is used. The water jet displaces the sand and permits the pole to be lowered the required depth. Before the adoption of



SETTING A POLE IN QUICKSAND WITH WATER JET

this scheme barrels were sunk in the quicksand and it was impossible to lower the poles more than 3.5 ft. to 4 ft. The use of the fire engine, however, overcame the trouble, and the jet works satisfactorily in all kinds of sand.

This method of setting poles is used by G. A. Frogner, superintendent of the municipal electric light and water plant of Gladstone, Mich.

Some Results Attributable to Inefficient Brush Contacts

BY E. C. PARHAM

Poor brush contacts may cause sparking or several other characteristic symptoms. On a bipolar generator it may render the machine unable to "build up" its field. This is not so likely to happen on a multipolar machine, however, unless the poor contacts are due to high mica or to excessive glazing of the commutator, because there are several independent sets of brushes and not so much chance of all making poor contact. High mica or a glazed commutator, however, will affect all brushes alike. On multipolar machines poor brush contacts will cause unequal division of the load among the several brushes or sets of brushes, thereby producing sparking and possibly overheating of some of the equalizing sectors. Also, where two or more machines are operated in parallel, poor brush contacts may materially affect the division of the total load among the machines. Even when the condition is not indicated by sparking, the shunts of the overloaded brushes are likely to become discolored by the heat of the abnormal currents carried by them, and if the condition goes on unnoticed the shunts will eventually burn out.

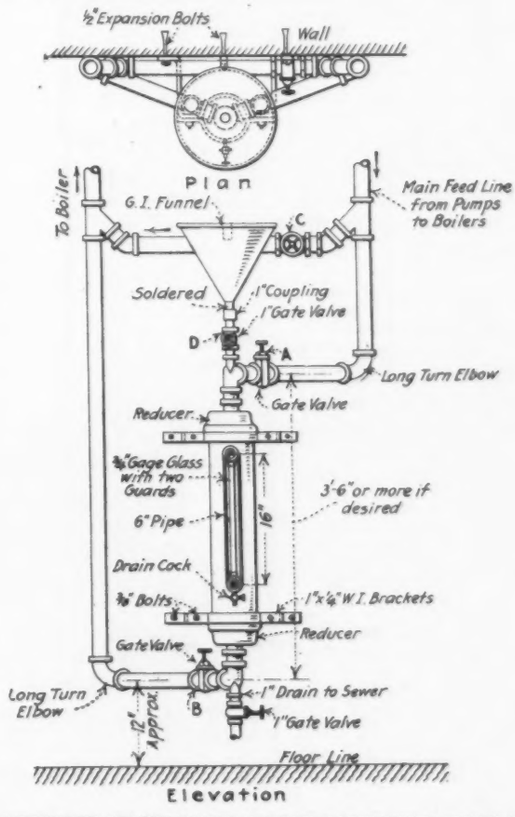
In one case a troubleman was called to look at a four-pole motor the sparking of which had been gradually getting worse. The operator claimed that the motor had been operating satisfactorily for several years and had begun to spark only within recent months. Upon removing a brush to inspect its contact surface it was noticed that the shunt was rather short. Further inspection disclosed that all of the shunts were too short, in fact, in many cases the shunts were actually holding the brushes away from the commutator. Comparison of the brushes with old ones that came with the motor showed that the shunts of the existing brushes were uniformly too short to permit of getting anything like full wear from brushes of that length. As a temporary relief the brush shunts were cut with pliers. This made it possible for the brushes to reach the commutator, which promptly took on a healthy polish. As a permanent relief a new set of brushes with standard pigtails was ordered. On all modern generators and motors it is the practice to attach a plate on which is given the catalog number of the brushes to be ordered for that unit.

Boiler-Compound Injector Made Up of Pipe Fittings

BY T. W. REYNOLDS

A device for injecting compounds into boilers that can be easily made up of pipe fittings at a slight cost and has proved satisfactory in operation is shown in the accompanying illustration. The injector is installed in a by-pass with the valves arranged as shown. The by-pass should be of the same size as the main feed line from the pumps, while the height and diameter of the chamber will vary in accordance with local conditions or the quantity of compound to be used at one time. Ordinarily a piece of 6-in. pipe 2 ft. long will suffice.

To cut out the injector, valve *C* is opened, then valves *A* and *B* closed. The contents of the chamber are discharged by opening the valve on the 1-in. drain to the sewer. To fill the chamber with compound, the latter valve is closed and valve *D* is opened. The charge is then injected into the boilers by closing valve *D*, opening valves *A* and *B*, and then by closing valve *C*, in the order mentioned.



ASSEMBLED HOME-MADE BOILER-COMPOUND INJECTOR

Campaigning Past the "Saturation Point"

A Story of Business Gained Where Figures Showed There Was None—Schedule of House-Wiring Prices at Columbus, Ga.

IT is a stimulating lesson to the man who thinks there is no business to be had in his town when a central station in a medium-sized city finds 143 new consumers in the face of statistics that proclaim a state of "saturation." Everybody used to talk and write about the time when all the houses would be wired and all the business that was worth the having would be tied up to the pole line. They worried much about this mystical point of saturation and "What would the central station do then, poor thing?" Just listen to what happened recently in Columbus, Ga.

Conditions in Columbus

Thomas W. Peters, the commercial agent of the Columbus Railroad Company, which serves Columbus with both electricity and gas, in addition to transportation, says:

"We serve approximately 40,000 population, and my impression is that the census gives five persons per family. This makes a total of approximately 8000 families in Columbus and vicinity, and if we eliminate, as we should, the 'no 'count nigger' and the class of white people whom the negro calls 'po' white trash,' we shall have the available number of families which we can serve down to approximately 4000. At the present we have on our lines a fraction over 4000 customers, from which you can see that we have practically reached the 100 per cent saturation point as far as customers go. Of course, in actual practice we find that we keep gaining customers from month to month, most of which are customers bringing us in only from $15 to $18 per year, but theoretically we have reached full saturation, when it comes to opportunity for winning profitable residence consumers."

Naturally, it has been a gradual development in Columbus as elsewhere, and continuous effort has brought its cumulation in the field both of lighting and of power. The better-class houses came first, the homes of the people of property; then the salesmen were directed toward the rented houses.

"At first," says Mr. Peters, "it was very hard to get the owners to realize that it was desirable to have their rented property wired, but the groundwork has been very thorough and our persistent efforts are beginning to show. There is hardly a house built in Columbus to-day which is not wired for electric light, and, as a matter of fact, for some time now our greatest effort in soliciting has been spent entirely on houses of three and four rooms which have been built for years."

It was determined, however, that in spite of figures a campaign of co-operation embracing the company and all the local contractors would probably result in the development of many hidden "prospects" and much apparently inaccessible business both for service and construction. Also, it was believed that such a campaign would benefit both the contractors and the company's sales force by the natural enthusiasm and co-ordination it would inspire. And so a flat-rate, easy-payment offer was worked out and the stage was set, the objective being to make a whirlwind drive on the small-house business waiting possibly among the homes that had been included in the 50 per cent of "ungettable" houses segregated in those figures that had dealt with "saturation."

The schedule of prices and points used in the campaign in Columbus is given on the following page.

Methods and Results

"The success of this campaign can readily be seen," says Mr. Peters, "in the fact that we secured 143 new electric customers in four weeks besides selling a good many appliances. Considerable newspaper space was used, a feature of which was the display of much red ink. The 'copy' was simplified and so worded as to influence the specific class of 'prospects' we were talking to. You will probably be surprised when I tell you that a good many wiring jobs were closed which called for easy payments distributed over terms of from six to eighteen months. We did not handle one of these accounts, however, the contractors assuming all responsibility of collections and carrying accounts. In addition, each contractor loaned us a man to supplement our own salesmen. On each Saturday night the commercial department gave a supper to its members and one or two invited guests, at which time prizes for the week were distributed. Everything was done to keep the campaign spirit strong and knit us all together in the work, and although this campaign was not so big a success from a numerical standpoint as some other campaigns, I believe it has helped us considerably and will continue to do so. Certainly it has demonstrated that there is no such thing as saturation.

"We have in Columbus what we call a patrol rate figured out on a flat-rate basis and applicable to signs and window lights. Almost 95 per cent of the merchants avail themselves of this service, and the other 10 per cent—or at least 9½ per cent of this 10 per cent—burn their lights on the meter every night. The development of power business has been even more successful, and it is our boast that there is not a shop or factory in

For the Mansion and Cottage
ELECTRIC LIGHTS
Are Better Than Any Other Form of Light, Except Daylight
The Cost of Wiring is Small and the Terms are Easy. Call 166 or 384 and Have a Solicitor Call and Explain Our
SPECIAL N
WIRING P
Columbus E
Going! Going! Gone!
Don't forget that to-day is the last day
pecial Prices on
se Wiring
ORDER MUST BE
ED BEFORE 6 P. M.
enable you to
the benefit of
. Prices. Call 166
84 for a solicitor
all and get your
er.
bus Railroad Co.
GOOD LIGHT IS NO LONGER A LUXURY
Electric Light Is the Best Light
Remember that this Is the Last Week of Our
SPECIAL HOUSE WIRING CAMPAIGN
Call 166 or 384 for a Solicitor to Come and Explain to you Our Proposition.
Columbus Railroad Co.

THREE ANTI-SATURATION ADVERTISEMENTS

Columbus which is not on our lines; that is, we are selling them either light or power, or both. We have all the woodworking plants in this territory connected to our lines, with most of them using electricity exclusively, and the plants not having a complete installation are the ones which have too much refuse to burn under the boilers heating their dry kilns.

"All of the fertilizer plants in this section are electrically driven, and there is only one cotton gin in this territory which is not driven by an electric motor. All of the smaller industries are driven exclusively by electric power. At present, however, there are adjacent to our lines two ice plants, one large machine shop and factory and two cottonseed-oil mills which are not using our service exclusively, but we hope within the next twelve months to be able to cut these exceptions to one.

"During the campaign we also obtained fifty-nine new gas customers and sold a good many extra gas appliances."

In other words, down in Columbus they believe in getting just as close to "saturation" as they can—and then a little closer.

WIRING PRICES IN COLUMBUS (GA.) CAMPAIGN

STORES

Two lamps	$5.00
Three lamps	7.00
Four lamps	8.50
Snap switches, extra, each	1.75

Terms: 10 per cent off for cash with order or $2 down and $1.50 per month until paid.

RESIDENCES

Three lamps	$7.50
Four lamps	9.00
Five lamps	11.50
Six lamps	14.00
Seven lamps	16.50
Eight lamps	19.00
Nine lamps	21.00
Ten lamps	22.50
Additional ceiling lamp complete	1.70
Additional side lamp complete	1.70
Snap switches, extra	1.75
Flush switches, extra	3.00

For two-story homes double the above price for the first floor, using regular price for second floor.

Terms: 10 per cent off for cash with order or one-quarter down when current is turned on, balance in four monthly payments.

NITROGEN LAMPS

200-watt	$3.00
300-watt	4.00
500-watt, Mogul socket	6.00
750-watt	6.50
400-watt	5.00
1000-watt	8.50
1500-watt	8.50
Mogul socket	1.00

Where the above lamp replaced Mazda lamps a credit of 50 per cent, original cost of Mazda lamp, was allowed.

POINTS TO BE AWARDED TO SALESMEN

	Points
Old houses wired	5
New houses wired	4
Old houses reconnected	3
Each heating device	1
Every $25 yearly revenue on flat rate	5
Every 200 watts additional load on present meter	1

POINTS ON GAS SALES

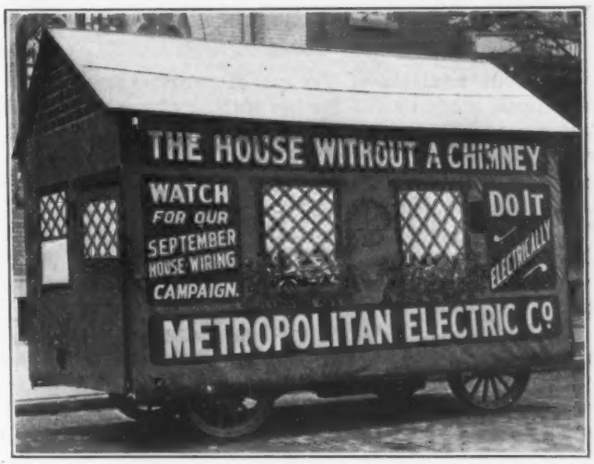
New stoves in old houses	5
Old stoves in old houses reconnected	4
Heaters and miscellaneous devices, additional business	2
Auto water heaters, additional business	5
Coke, 0.5 ton	2

PRIZES (IN GOLD)

200 points or more per week	$2.50
Highest number of points per week	2.50
Highest number of points during campaign	5.00

A Perambulating "House Without a Chimney" at Reading, Pa.

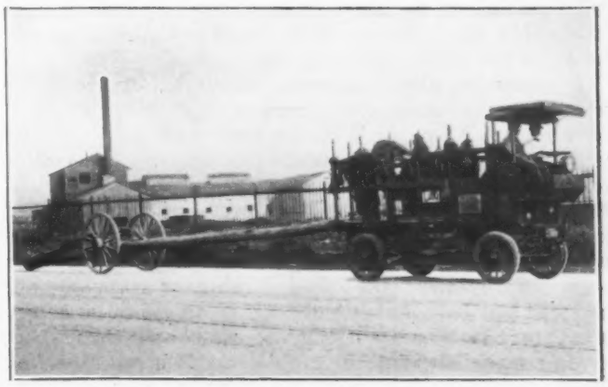
As the "opening gun" in its fall house-wiring campaign, the Metropolitan Electric Company, Reading, Pa., fitted up one of its electric trucks to represent a bungalow without a chimney. In order to attract attention to this float and to arouse interest in the campaign, the slogan "The House Without a Chimney" was adopted and painted on the sides of the float, together with a notice of the coming campaign. The truck was decorated with miniature electric lamps and a string orchestra inside the "house" played popular music as the truck made its way through the residential districts. In the business section of the town the truck was stopped from time to time at favorable locations while impromptu concerts were given. Charles J. Esterly, sales agent of the company, who conceived the idea, attributes much of the success thus far obtained in the company's campaign to the use of the float.



A FLOAT WHICH CONVEYED A DEFINITE IDEA

Electric Vehicles Used for Pole-Line Work

In Long Island City, N. Y., and the surrounding territory the New York & Queens Electric Light & Power Company makes extensive use of its 4000-lb. electric trucks in pole-line work. These trucks are not only used to transport wire, insulators, pole-line tools, etc., but also for the transportation of poles. The accompanying illustration shows how the latter is accomplished, one end of the pole being fastened to the rear of the truck, while most of the weight is supported by a "dolly" or pair of wheels as shown.



"OFF FOR THE JOB" WITH POLE AND TACKLE

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

The Light and Heat Factors in Department-Store Costs

A recent analysis of groups of representative business firms, made by the Boston Edison company, showed that the average expense, outside of merchandise itself, was 21.5 per cent—salaries running 3 per cent, insurance and taxes 1 per cent, while light and heat ran from 0.3 per cent to 0.9 per cent and averaged 0.5 per cent. The highest figure for light and heat was 0.9 per cent. This was for department stores, for which the total expense for salaries, rent, light, heat, etc., was 24.4 per cent of the sales.

If, therefore, a department store should produce its own light, it would save only an amount equal to 0.9 per cent of its sales, even if it produced light for nothing. In reality, if such a department store produces its own light, it unconsciously increases the rent, salary, supplies, insurance, taxes and general expenses, with depreciation and all similar accounts. These, brought together, amount to from twenty to forty times the total of light and heat; so that it would take but a very nominal increase in all these other expenses, and one easily unnoticed, to wipe out any saving if the department store produced its own light. Indeed, as pointed out by L. D. Gibbs, if a department-store manager could by hard work cut his expenses of light and heat in two he would not increase the profits as much as if he merely increased his sales by a very small amount without increasing his cash expenditures.

New Developments in Electric Heating for Shoemaking Machinery

In factories making men's Goodyear welt shoes, which retail from $3.50 to $8 per pair, it has been at times difficult to interest the owner in central-station motor service because in Massachusetts the owner is under such conditions required to employ a licensed fireman to operate his boiler at 50 lb. gage pressure to supply heat for his manufacturing processes.

In order to make it easier to secure shoe-factory business by eliminating the necessity of using high-pressure steam, Stone & Webster two years ago took up with the United Shoe Machinery Company the matter of making an electrically heated welter and stitcher. In March, 1914, the Shoe Machinery company installed in one of the factories on Brockton Edison service a machine of this type for experimental service, and after some improvement the Shoe Machinery company announced last July that it had adopted an electrical equipment for heating its Goodyear welt and turn shoe-sewing machines, outsole rapid lockstitch machine and rapid bobbin-winding machine. Present machines can also be arranged for electric heating. The equipment, according to D. M. Debard, requires 5.3 amp. at 110 volts. In a given trial period 48,384 pairs of men's shoes were welted, requiring 1082 kw.-hr. for heating the wax pots. The energy consumption was, therefore, 2.23 kw.-hr. per 100 pairs. The average electric heating rate was 2.45 cents per kilowatt-hour, making the electric heating cost 5.46 cents per 100 pairs, whereas with steam the cost would have been close to 50 cents.

With the introduction of these electrically heated machines, the shoe-factory steam requirements are now reduced to those of a low-pressure heating plant with the safety valve set for 15 lb. per square inch—a plant which can be operated by any laborer working part time.

Picturing Past and Present in a Rutland Window Display

The accompanying photograph of the show window of the Rutland (Vt.) Railway & Light Company illustrates a recent exhibit made by the commercial department of the company for the purpose of emphasizing to the public the difference between the modern high-efficiency

"YESTERDAY AND TO-DAY" CONTRASTED IN LAMPS AND LOCOMOTION

tungsten lamp and the old-fashioned carbon lamp. The old velocipede displayed was borrowed from the estate of an old Rutland family and attracted great attention locally. According to B. T. Burt, vice-president and general manager of the company, this window display proved itself an excellent advertisement for the company's service.

Fixed-Price Central-Station Power and Steam-Heating Service

The Providence (R. I.) Steam Company, a subsidiary of the Narragansett Electric Lighting Company, has a plan by which it takes over the operation of existing plants and furnishes light, heat and power to the customers for a fixed sum per year. If the cost of producing this service is less than the charge made, the saving above 110 per cent of the agreed-upon cost is returned to the customer. The engineering force of the customer remains at its usual work by this arrangement. Providence customers whose demand and energy consumption can be readily obtained, can be supplied, if desired, at a flat rate per kilowatt-hour which approximates the regular sliding scale of charges. This arrangement has been approved by the Public Utility Commission.

WHICH CAGE IN THE ZOO ATTRACTS THE CROWD? WHY NOT, THEN, APPLY THE SAME IDEA TO A SHOW WINDOW?

A Window Demonstration That Nearly Tripled Lamp Sales

Average daily lamp sales, which had previously been running from $15 to $20, jumped to $47 a day during the two weeks the monkey exhibit illustrated herewith occupied the window of the Electric Lighting Supply Company at Los Angeles, Cal. Indeed, the window drew such crowds that a traffic officer had to be stationed near by to keep people from blocking the sidewalk.

The live monkeys for the display were secured from the Jungle Motion Picture Corporation, and the illuminated lamps, in lamp guards, received plenty of shaking to emphasize the text of the principal sign in the foreground. The window was planned and installed by the proprietors of the company, F. H. Trimble and C. F. Baker.

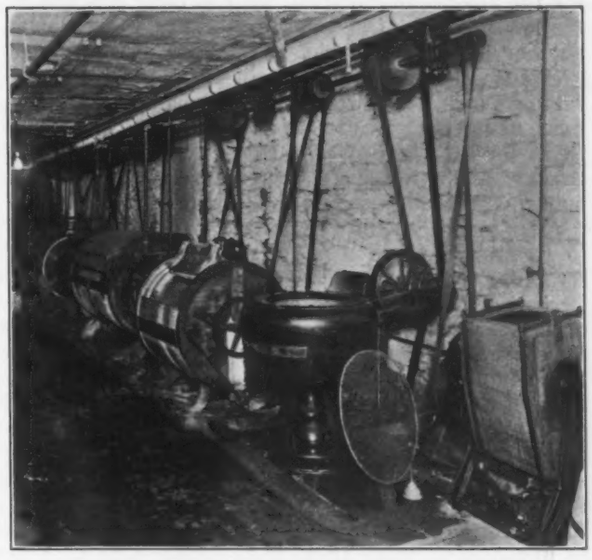
Getting Illumination Loads During Conventions

Recognizing that conventions result in bringing a comparatively large amount of business to merchants in the convention city and incidentally increase the illumination and trolley loads, the Metropolitan Electric Company, Reading, Pa., co-operates with the business men and the publicity and convention committees of the Chamber of Commerce in their organized efforts not only to bring conventions to the city but also to make such conventions when held highly successful. During a recent convention which lasted a week Charles J. Esterly, sales agent of the company, was successful in obtaining special illumination for the occasion in the form of an electrically lighted "court of honor." This court was over a half mile in length, and its beauty was augmented by the private electrical displays made by the merchants, a special campaign being made for this class of lighting. Form letters were sent to the merchants offering a flat rate for "fairyland" lighting displays. These letters, together with personal calls by salesmen as a "follow-up," brought excellent results.

"COURT OF HONOR" ILLUMINATION AT READING, PA.

Data on Motor-Driven Laundry Equipment

The advantages of electric drive and of a reliable source of power hardly need emphasizing, but in the case of a laundry it may be pointed out that if purchased energy is used for operating laundry machinery, then only water heaters instead of expensive high-pressure boilers will be required. In the Wright Laundry, 424 Columbus Avenue, New York City, the washing-room of which is shown herewith, central-station service is employed to operate all of the equipment. One of the motors, rated at 7.5 hp., drives a line shaft to which are connected four cylindrical washers, two centrifugal extractors and a starcher. A 0.5-hp. motor operates a blower, and the ironing machines are driven by a 3-hp. motor. Several months' records show an average monthly energy consumption of 1600 kw.-hr., or 145.5 kw.-hr. per connected horsepower. The United Electric Light & Power Company furnishes the service.



MOTOR-DRIVEN MACHINES IN WRIGHT LAUNDRY

Commonwealth Edison Opening Attended by 20,000

About 20,000 persons visited the Edison Building, Chicago, the new headquarters of the Commonwealth Edison Company, during the "opening" week, Sept. 20 to 25, reference to which was made in these columns.

The building was specially illuminated, and the first, second and third floors, as well as the service bureau, telephone exchange and load dispatcher's office on other floors, were thrown open to the public from 8.30 a. m. to 10 p. m. There were free concerts of classical and popular music every evening in Customers' Hall (second floor) by the Commonwealth Edison Orchestra, of

which Morgan L. Eastman is conductor. This orchestra, of 100 pieces, is believed to be the largest of its kind in the country. It is composed entirely of employees of the Commonwealth Edison Company. There was also an interesting motion-picture show, to which admission was free. In the handsome Electric Shop on the ground floor samples of electrically baked cake were given away, tea from an electric samovar was served by a Japanese girl in native costume, and various electrical appliances were demonstrated.

COST-KEEPING ON ELECTRICAL CONTRACTS

Collecting Data for Estimating Labor Charges with Accuracy—Proportion of Expenses to Be Assigned to "Overhead"

At the Springfield (Mass.) convention of New England electrical contractors J. P. Coghlin of the Coghlin Electric Company, Worcester, Mass., read an extended paper on "How to Estimate Cost and Keep Accounts."

The author criticised the tendency of contractors to guess at labor costs in estimating, with the result that a large amount of electrical work is done at a loss or at too low a profit. Omission of items in the estimate is another cause of trouble, and taking chances because previous jobs have been lost in competition is a third reason for losses. The paper emphasized the importance of having an estimate sheet with printed material items for each kind of work done by the electrical contractor, and with space for materials estimated and materials actually used on the job.

All material should be checked back, noting that fit to go into stock when not used, that suitable only for scrapping, and that actually employed in the work. Periodical checking of material is one of the best means of acquiring the ability to make close estimates. Both material and labor are saved when the workmen know that the work is being carefully followed in the office. Too often contractors spend hours scaling plans in the effort to estimate materials accurately and then conclude the estimate with the roughest labor percentages.

In the author's experience in checking up the costs of contracts on new-house work, labor will run from 40 to 50 per cent, on old-house work from 50 to 65 per cent, on iron-conduit work from 33 to 55 per cent with fireproof construction, and on iron conduit with wooden construction from 50 to 75 per cent.

Computing Labor by the Unit System

The best way to figure labor is by the unit system, finding out the cost, per foot of wire installed, on knobs and tubes, running wire on cleat work, pulling wire into conduit, the cost per foot of running conduit on different kinds of construction, cost of setting switch boxes, of connecting cut-out cabinets, per circuit, etc. The only certain method of finding out these labor costs is through time slips sent to the office each day, no matter where the job is being done. On these slips should be indicated the kind of work done, the hours required to do it, the quantity of material installed during this period, and the nature of the conditions under which the work was done. The average of a series of these gives the unit cost of labor. No firm, no matter how small, can afford to omit this practice. No business, electrical or otherwise, the author said, can succeed unless it knows the cost and figures in overhead expenses and profits. The study of cost sheets is an invaluable practice. Lines of work which the contractor finds profitable should be cultivated, leaving to his competitor the other classes of work. Time slips should be large enough for the workmen to give all the story.

To carry out such a system in detail, one additional girl in the office at about $8 a week is all that is necessary—not an expert bookkeeper but a girl who is accurate at figures. Such an investment will save many times the cost at the end of a year, and with it the contractor will find that he is beginning to be a bigger man, with more time to give to other matters and with a growing business besides.

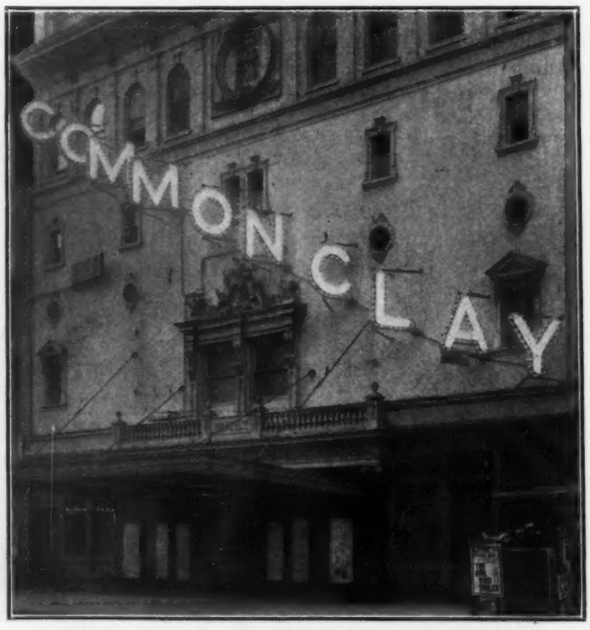
Overhead Expenses

The approved way to determine overhead expenses, said Mr. Coghlin, is to keep an accurate account of every outlay in the business. Even a contractor with no office who does his own work with one or two men finds that his overhead cost runs from 30 to 40 per cent of the gross business. First, he must charge a reasonable amount for his own wages, at least as much as if employed by another. If he carries a stock of goods, the interest on the money thus invested, insurance, telephone rental, advertising, purchase of tickets, dues in clubs, association contributions, etc., all count.

Giving his men 10 or 15 cents at a time for gasoline, solder, car fares, etc., amounts to quite a sum viewed annually. Automobile running costs, horse hire, stabling, etc., also fall within this group. Everything should be charged and the bookkeeper instructed to separate productive from non-productive items, the latter being those which cannot actually be charged against the job, whether contract or stock and labor. Bad bills, collecting cost, and broken, lost or stolen stock must be added.

An Effective Sign for Side Streets

A type of electric sign which is effective, comparatively low in cost and well adapted for use on buildings situated on side streets in view of a main thoroughfare, particularly where little overhang is allowed by city ordinances, has recently been installed in several Eastern cities. The sign illustrated, which is on the front of the Republic Theater, New York City, is so arranged that it can easily be seen from Broadway, a short block distant. A separate angle-iron support is provided for each letter, the letters themselves being set at an angle to the building wall. The installation was made by Strauss & Company and energy for lighting the sign is furnished by the New York Edison Company.



A NEW TYPE OF SIGN OVERLOOKING BROADWAY

Technical Advance in Theory and Practice

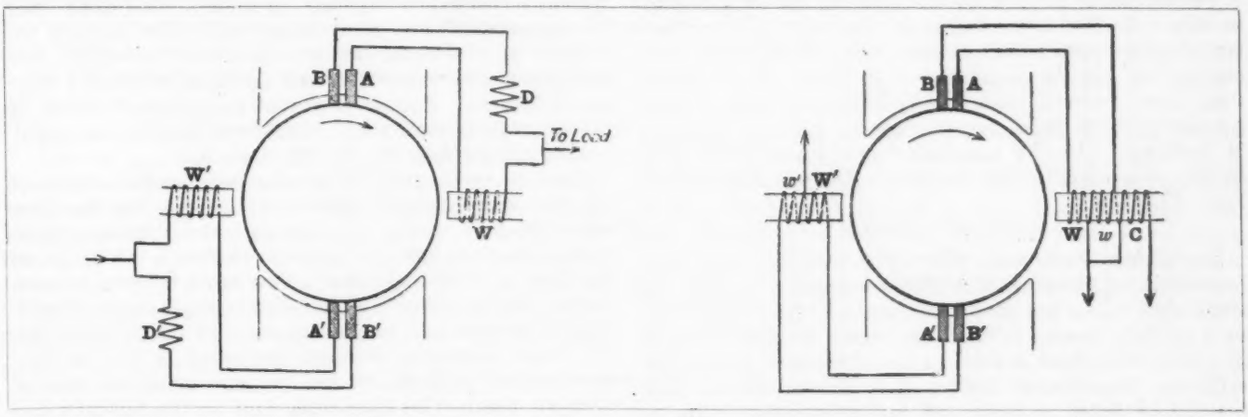
Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

COMMUTATION AT OVERLOADS

Description of an Automatic Adjustment Designed for Interpole Machines

At the recent convention of the British Association for the Advancement of Science, Miles Walker read an interesting paper on a self-adjusting commutating device for interpole motors which is both theoretically interesting and practically valuable. It is well known that direct-current machines with interpoles will not, without readjustment, commutate very heavy overloads, owing to the magnetic saturation which occurs in the iron of the interpole. When the excitation becomes very great the saturation of the iron interferes with the proportionality that should exist between the current to be commutated and the commutating flux. The rating of a frame, regarded from the commutating point of view, may be very much increased if for all loads the excitation of the interpole can be automatically varied so as to give the right commutating field. The arrangement shown in Fig. 1 was first tried at the Manchester School of Technology. Its object is to produce automatically the right amount of commutating flux from very wide ranges of load. The brush (say the positive brush) consists of two parts, one part (*A*) being slightly in advance of the other (*B*) on the commutator and lightly insulated from it. The winding on the commutating pole has twice as many turns as one would ordinarily have, and the cross-section of the copper conductor is only sufficient to carry one-half the current continuously. Thus the weight of copper on the commutating pole is the same as on machines as at present constructed. The part of the brush *B* may be connected through a diverter *D*, having the same resistance as the winding *W*, or the diverter may be dispensed with altogether. The direction of rotation of the machine in Fig. 1 is supposed to be clockwise. The action is as follows:

Assuming that the number of turns on the commutating pole is such as to give the right commutating flux when half current is passing through them, then it will be found that the current will divide evenly between *A* and *B*, because the correct excitation of the commutating pole gives an even distribution of current over the face of the compound brush *AB*. If, however, the number of turns in *W* is too great, there is a tendency to over-commutation; that is to say, the current in *B* becomes greater and the current in *A* less. This has the effect of automatically weakening the commutating pole, and the pole remains of just such a strength as to bring about the required distribution of current between *A* and *B*. It will be found that on machines of ordinary rating, and more particularly on machines of very large rating, the "correcting" voltage between *A* and *B* necessary to bring about a suitable division of current between the two brushes is normally very small, being of the order of 0.5 volt, whereas the voltage which can be generated between *A* and *B* because of a pole being too weak or too strong may easily amount to 5 volts or more. Thus a very little disturbance in the equality of loading on brushes *A* and *B* is sufficient to yield the desired "correcting" voltage. If for any reason that commutating pole tends to become too weak owing, let us say, to the saturation of the iron of the pole, the self-induction of the armature coils carries the current forward to brush *A* and tends automatically to increase the excitation of the commutating pole. The other brush (say the negative brush) may be either a simple one or it may be divided into brush *A'* and *B'*. In this case half the commutating poles would be in series with *A* and the other half in series with *A'*.



FIGS. 1 AND 2—WIRING ARRANGEMENTS FOR DOUBLE BRUSH GEAR OF 500-VOLT ROTARY CONVERTER

In actual tests with the correcting device the machine would take nine times full-load current without sparking, whereas with a normal adjustment of the diverter the machine sparked badly at a lower load. A 500-kw., 500-volt rotary converter, built by the British Westinghouse company, was fitted with the double brush gear, arranged as in Fig. 1, and was found to give most excellent results. The machine was loaded by circulating the power through a 1000-kw. converter provided with an alternating-current booster. It was found that with 3000 amp. (the largest current which could be circulated through rotaries and transformers with the existing arrangement) flowing the commutation was sparkless. The device is being at present installed on a 1500-kw. rotary converter, on which the commutating conditions would otherwise be rather difficult.

An alternative arrangement is shown in Fig. 2. Here

the current coming from B passes round the coil w, so as to give some opposing ampere-turns on the interpole. If the W turns are sufficiently great to wipe out the w turns and give the required excitation, then the arrangement works as described in connection with Fig. 1. If it is desired to keep W and w the same, then the extra turns C can be added as shown in Fig. 2. It is found in practice that the simple arrangement shown in Fig. 1 is sufficiently effective. The paper abstracted is published in the London *Electrician*, Sept. 17, 1915.

Generators, Motors and Transformers

Leakage Flux Calculations.—J. F. H. Douglas.—A mathematical paper illustrated by diagrams in which the author points out that accuracy in leakage calculations is as important as in any other flux calculations in an electric machine. The customary formulas for leakage flux permeance give values which are much too small. A table of leakage permeance is given in this paper with values of permeance much nearer the truth. The most convenient way to use these would be to plot the table in the form of a curve. The effect of distributed pole-core leakage may be taken into account by assuming that 72 per cent of the leakage occurs at the pole tips, or else that all the leakage occurs at a point exactly half way between the pole tips and the pole yoke. —London *Electrician*, Sept. 17, 1915.

Transformer Core Loss as Affected by Triple Harmonics.—H. M. Lacey and C. H. Stubbings.—An illustrated paper read before Section G of the British Association for the Advancement of Science. It is shown that there is considerable saving in the core loss of star-connected three-phase transformers if the neutral point is insulated. In the particular case investigated this saving amounted to 22.5 per cent.—London *Electrician*, Sept. 17, 1915.

Lamps and Lighting

Sterilizing Water with Ultra-Violet Light.—An illustrated description of the Billon-Daguerre system of sterilizing water by ultra-violet rays. The special feature of this system is that the water is made to flow in a very thin sheet across a zone of intense ultra-violet radiation immediately before it is drawn off for use. Instead of drawing water off indiscriminately from a

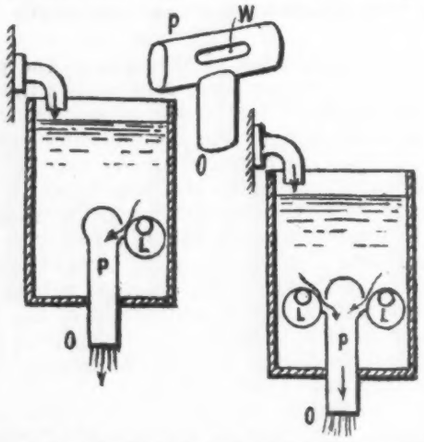


FIG. 3—ARRANGEMENT OF STERILIZING SYSTEM

tank full of more or less completely sterilized liquid, a T-shaped outlet pipe P (Fig. 3) is used. This is of pure transparent quartz and has a horizontal window or slot W, so that liquid drawn off at O has to pass in a thin sheet over the surface of a mercury-vapor lamp L, and is thus subjected to maximum ultra-violet action. To deal with large quantities of water—say, 1000 gal. to 2500 gal. per hour—the intake of the outlet piece is provided with a slot on each side, and two quartz-mercury lamps are used as shown to the right of Fig. 3. These lamps may consume about 4 amp. and be used in series on a 100-110-volt circuit (the actual lamp potential difference being about 43 volts each). The gross energy consumption thus works out at about 0.2 kw.-hr. per 1000 gal. sterilized, and the cost of treatment is negligibly small.—London *Electrician*, Sept. 17, 1915.

Traction

Electric Canal Haulage.—An illustrated article describing the haulage system on the Trent and Mersey Canal, which has two long tunnels. A motor barge hauls itself along a fixed steel cable laid on the bed of the canal. Electric motors work the haulage machinery in the barge, the energy for these being obtained from another boat containing accumulators which follows immediately behind the tow barge. There is not sufficient headroom in the tunnel for overhead-trolley collection cables.—London *Electrician*, Sept. 17, 1915.

Installations, Systems and Appliances

Electricity on Board Ship.—O. Krell.—A long illustrated serial in which, after a historical sketch of the use of electricity on board ship, modern electric installations for light and power are described, with special reference to the difference of practice on board ship and on land. On board ship compact construction, small weight, resistance against weather conditions and "foolproofness" are most important. The electric installations of submarines are described in detail. For traction under water they are equipped with lead storage batteries. The development and present status of searchlamps is dealt with. The serial is to be continued. —*Elek. Zeit.*, Aug. 12, 19, 26, Sept. 9.

Glasgow.—An abstract of the last annual report of the municipal electric station of Glasgow for the year ended May 31, 1915. At that date the number of consumers was 32,030, as against 30,098 in 1914, or an increase of 6.42 per cent. The sales to private consumers amounted to 85,718,795 kw.-hr., compared with 73,988,649 kw.-hr., or an increase of 15.85 per cent. The total maximum demand connected is 101,148 kw., as compared with 89,592 kw. in 1914, or an increase of 12.9 per cent. The maximum load on the busbars was reached on Dec. 7 last, when the demand was 39,750 kw. The load-factor has improved and now stands at 25.5, which shows a notable advance on the previous figure of 22.8. The total cost, including capital charge, was 1.9 cents per kilowatt-hour sold, against 2 cents last year. The total revenue was 2.18 cents, so that there was a balance of 0.28 cent per kilowatt-hour sold.—London *Electrician*, Sept. 17, 1915.

Wires, Wiring and Conduits

Aluminum Alloys.—Ernest Wilson.—A British Association paper on the results of tests of light aluminum alloys in which the influence of exposure to the London atmosphere upon the electric resistance of the alloys was studied.—London *Electrician*, Sept. 17, 1915.

Electrophysics and Magnetism

Heating of Iron When Magnetized at Very High Frequencies.—N. W. McLachlan.—A paper read before Section G of the British Association. Iron is heated by eddy currents produced in alternating fields of high frequency, between 3×10^5 and 5×10^6 cycles. Various general results are described as regards losses, permeability and skin effect. When iron is heated above a temperature of about 700 deg. C.—i. e., above the recalescence point Ac_1—it passes from the alpha state to the beta state. The former is magnetic while the latter is non-magnetic. Just before reaching the point

Ac_i, the permeability, provided the magnetizing force is weak—say, 0.4 C.G.S. unit—increases very rapidly for a comparatively small increase in temperature, attains a maximum value somewhat after the nature of a resonance curve, and then suddenly drops to unity when the iron reaches the non-magnetic state.—London *Electrician*, Sept. 17, 1915.

Magnetism.—An account of a lecture by Professor Weiss before the British Association on new theories of magnetism, and especially on the magneton hypothesis. An account of the discussion which followed is also given.—London *Electrician*, Sept. 17, 1915.

Magnetic Field.—O. BILLIEUX.—A mathematical paper giving analytic expressions of the intensity of a magnetic field.—*La Lumière Elec.*, Aug. 14 and 21, 1915.

Electrochemistry and Batteries

Electrolytic Copper Refining.—A. C. CLARK AND L. ADDICKS.—Abstracts of two papers read before the International Engineering Congress on the development and present status of electrolytic copper refining.—*Met. and Chem. Eng'ing*, Oct. 1, 1915.

Electrolytic Iron.—L. GUILLET.—A sketch of different electrolytic processes for iron refining. The latest process is that of a French company which uses a revolving cathode and a neutral solution of ferrous salts. The results obtained in practice are described and the properties of electrolytic iron are discussed. Its industrial uses are either in form of tubes or of plates (especially for the construction of dynamo-electric machinery), or as a starting material for remelting.—*Revue de Métallurgie*, February, 1915; *La Lumière Elec.*, Sept. 11, 1915.

Units, Measurements and Instruments

Instrument Transformer.—E. PFIFFNER.—Voltmeters, ammeters and other meters are usually connected to the network by means of series transformers. While in the design of commercial instrument transformers the secondary current may be selected at will, designers usually choose a secondary current of 1 amp., 5 amp. or 10 amp., these figures relating to normal full load. The author shows why the choice of 1 amp. is the most advantageous one. It has, however, the disadvantage that in case of an accidental break in the secondary circuit with many windings a voltage is induced which may be 1000 volts or more so that an insulation break-down of the secondary winding may result. This disadvantage can be avoided if the magnetic core is so designed that a section of it is saturated so that the magnetic flux cannot increase beyond a certain value.—*Elek. u. Masch.* (Vienna), July 13, 1915.

Indicators for Rifle Ranges.—An illustrated description of an electric system for rifle ranges for indicating at a distance the value of each shot.—London *Elec. Review*, Sept. 10, 1915.

Telegraphy, Telephony and Signals

Capacity of Aerials.—G. W. O. HOWE.—The author calculates the capacity of aerials of the umbrella type according to a general method which he published last year. The calculated results agree with those of measurement within the errors of observation and estimation.—London *Electrician*, Sept. 17, 1915.

Wireless Relays.—A note on a recent British patent (No. 252, 1914) of G. von Arco and A. Meissner for a relay for alternating current, particularly suitable for wireless telegraphy and telephony, employing a bulb containing an ionized-gas path in which the current, strengthened by the relay, is led with unchanged frequency directly or indirectly to the primary circuit of the relay again, so that the whole of the current or a part thereof repeatedly passes through the relay and is further strengthened.—London *Elec. Eng'ing*, Sept. 16, 1915.

Miscellaneous

Bullet Locater.—A note on a recent British patent (No. 23,170, 1914) of D. Finlay. A probe consisting of a silver tube insulated from a central rod, the head of which protrudes from and is also insulated from the tube, is connected to a telephone circuit. A sound is heard in the telephone when the flow of current between the tube and the rod through the tissues is redistributed by the proximity of a metal object.—London *Elec. Eng'ing*, Sept. 9, 1915.

Book Reviews

ALTERNATING-CURRENT WORK. By W. Perren Maycock. New York: Macmillan & Company. 416 pages, 258 illus. Price, $2.25.

This is a revised edition of the author's earlier work, "The Alternating-Current Circuit and Motor," extended to include generators and transformers and intended for readers who have an elementary knowledge of the continuous-current side of electrical engineering. The book opens with an explanation of the theory regarding alternating currents, mechanical analogies being used extensively to clear up some of the intangible ideas connected therewith. The methods of using vectors are explained, but no complicated mathematics is employed anywhere in the book. Before discussing the operation of alternating-current apparatus the author explains what relation power and energy bear to emf. and current and describes how they are measured. The major part of the book is devoted to describing typical forms of apparatus, explaining their operating principles, and outlining their purposes and limitations. Wherever illustrations of apparatus are shown the manufacturer's name is given below in the explanatory caption. At the end of each chapter are examination questions which serve to "drive home" and correlate the principles brought out in the preceding text. The book is completely indexed as to subject matter, illustrations and formulas.

HANDBOOK OF MATHEMATICS FOR ENGINEERS. By L. A. Waterbury. New York: John Wiley & Sons, Inc. 214 pages, 80 illus. Price, $1.50.

The first half of this concise little pocket reference book is devoted to formulas required in engineering problems involving algebra, trigonometry, analytic geometry, differential and integral calculus, theoretical mechanics, dynamics, mechanics of materials or hydraulics. Brief explanatory remarks and illustrations show how these formulas should be applied. The latter half contains five-place logarithms of numbers and functions of angles as well as the natural value of the latter and conversion factors. The book is provided with a thumb index in addition to the usual index.

Books Received

Physik. Edited by E. Warburg. Leipzig and Berlin: B. G. Teubner. 762 pages, 106 illus. Price, 24 marks.

Telephone Appraisal Practice. By J. C. Slippy. Published by the author at 429 Oliver Building, Pittsburgh, Pa. 100 pages. Price, $4.

Principles of Direct-Current Machines. By Prof. Alexander S. Langsdorf. New York: McGraw-Hill Book Company, Inc. 404 pages, 313 illus. Price, $3.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. J. COOPER

John J. Cooper, who was elected president of the Colorado Electric Light, Power & Railway Association at its Glenwood Springs convention, is secretary and operating manager of the Gilpin County Light, Heat & Power Company, the Arkansas Valley Electric Company, and the Brush Light & Power Company, and is vice-president of the Hinsdale Mining & Development Company. He has lived twenty-five years in Colorado and has always been engaged in the electrical business, having worked his way up from office boy and stenographer. He was at one time manager of the Trinidad Gas & Electric Company and is at present stationed in Denver as manager of the supply department of the Mountain Electric Company.

C. A. Menk of the Carnegie Steel Company, Homestead Works, Homestead, Pa., was elected second vice-president of the Association of Iron and Steel Electrical Engineers at the time of its recent convention at Detroit, Mich.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, Mass., left recently for a six weeks' trip to the Pacific Coast. He was accompanied by Mrs. Edgar and plans to be at the San Francisco Exposition on Oct. 21, which day will be devoted to a celebration of Mr. Edison's achievements.

G. H. Gamper has severed his connection with the Ohio Electric Securities Company as general manager and consulting engineer, and has been retained by the city of Columbus, Ohio, to check up the appraisals made by the Columbus Railway & Light Company on its properties. After completing this work Mr. Gamper expects to take up practice as a consulting engineer.

William H. O'Brien, chief of the telephone and telegraph bureau of the Massachusetts Public Service Commission, has been designated to represent the board at the forthcoming convention of railroad commissioners in San Francisco, as a mark of appreciation of his services since the inauguration of the bureau. He will also represent former Commissioner Clinton White on the telephone and telegraph committee of the association. Mr. O'Brien will return in about three weeks.

Nicholas J. Whelan, a former Speaker of the House of Representatives of the State of Michigan, and well-known at Lansing, the capital city, has become industrial commissioner for the American Public Utilities Company at Eau Claire, Wis.

B. B. Hogue has been appointed publicity manager for the Dallas (Tex.) Electric Company. Mr. Hogue was formerly associate editor of the *Times-Herald* of Dallas, and in his new position he will also serve as assistant to E. T. Moore, the general manager of the Dallas property.

E. S. Marlow, manager of the commercial department of the Potomac Electric Power Company, Washington, D. C., is critically ill at a Washington hospital and is receiving the sincere sympathy of his many friends throughout the electrical industry, and in the Electric Vehicle Association and Illuminating Engineering Society, in which he has been so active. Mr. Marlow began his electrical career as office boy and assistant bookkeeper for the old United States Electric Light Company, the pioneer utility corporation of the city. Through various positions he was promoted until at the time of the consolidation of the United States company with the Potomac Electric Power Company he was manager and treasurer of the former. Mr. Marlow has been active in the work of the Electric Vehicle Association of America and served as the first chairman of its Washington section, as well as the Washington member of the national committee on parcel-post delivery. He was chairman of the general convention committee of the Illuminating Engineering Society, which from Sept. 20 to 23 held the largest convention of its history at Washington.

E. S. MARLOW

W. L. R. EMMET

W. Le Roy Emmet, appointed to represent the American Society of Mechanical Engineers on the Naval Advisory Board, is himself a graduate of the United States Naval Academy and served in the navy from 1881 to 1883 and during the Spanish-American War. For many years Mr. Emmet has devoted much of his time to the study of electric ship propulsion, and he is the designer of the electrical propulsion equipment on the U. S. collier Jupiter, the success of which has led to the use of electric drive on the new battleship California. Mr. Emmet has been connected with the General Electric Company at Schenectady, N. Y., since 1892, and much of his present and past work with the company has been in connection with the development of the steam turbine. Mr. Emmet has also conducted extensive experiments with mercury vapor as a substitute for steam in the higher-temperature stages of turbines and has developed a model mercury turbine.

F. F. Johnson, formerly cashier of the Boise (Idaho) City National Bank, has been appointed president of the Electrical Investment Company, which will operate the power companies in southern Idaho controlled by the Electric Bond & Share Company until the properties are disposed of through public sale. It is reported that Mr. Johnson will also head the company which will permanently operate these properties.

T. Lee Miller, who has been placed in charge of the Sangamo Electric Company's New York office, 50 Church Street, was graduated from Cornell in 1909. Establishing connections with Warwick, Mitchell, Peat & Company, accountants, he originated and established the present efficiency system for the Buick Motor Company. For the past four and a half years he has been associated with the Toledo Railways & Light Company in the capacity of assistant to the president and manager in charge of operations. Mr. Miller is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the National Electric Light Association, the Racquet and Tennis Club, and the Cornell University Club of New York City.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Silver-Plated-Nickel Electric-Cooking Appliances

Electrically operated cooking appliances of beautiful old-English chased pattern and of American-Sheffield silver-plate construction have recently been brought out by Landers, Frary & Clark, New Britain, Conn. The silver is plated on a fine quality of solid white nickel-silver. All the appliances shown herewith, excepting the toaster, are equipped with a fusible-plug safety device. The coffee urn shown in Fig. 1 is rated at 450 watts and is being made in two sizes, the capacity of one being six cups and that of the other nine cups. The smaller urn weighs 10 lb. and is 15.5 in. high, while

FIGS. 1 AND 2—COFFEE-URN SET AND COFFEE PERCOLATOR

the larger weighs 11 lb. and is 17.5 in. high. The tray for the urn set is 12 in. by 18 in.

The electric coffee percolator shown in Fig. 2 is also made in two sizes, the capacity of one being six cups and that of the other nine cups. The smaller percolator is 9.5 in. high and weighs 5 lb., and the larger is 11 in. high and weighs 6 lb. The percolator has a rating of 450 watts. Another coffee urn is shown in Fig. 3. It takes 450 watts and is built in two sizes, the capacity of one being six cups and that of the other nine cups. The weight of the smaller is 8.25 lb. and it is 13.5 in. high. The larger urn weighs 9.25 lb. and is 15 in. high. The electric teapot shown in Fig. 4 takes 450 watts, has a capacity of six cups, weighs 4 lb., and is 8.75 in. high. The tea-ball samovar illustrated in Fig. 5 takes

FIGS. 3, 4 AND 5—COFFEE URN, TEA-BALL TEAPOT, AND TEA-BALL SAMOVAR

450 watts, has a capacity of six cups, weighs 9 lb., and is 11.75 in. high.

In Fig. 6 is shown an electrically operated hot-water kettle, which has a capacity of 2.5 pints, weighs 4 lb., is 9.5 in. high, and takes 450 watts. The electric chafing dish shown in Fig. 7 is equipped with an ebonized handle, weighs 12.5 lb., and takes 450 watts at high heat and 160 watts at low heat. The electric toaster illustrated in Fig. 8 is 6⅝ in. high, weighs 2⅞ lb., and is rated at 340 watts. Each of the above devices is

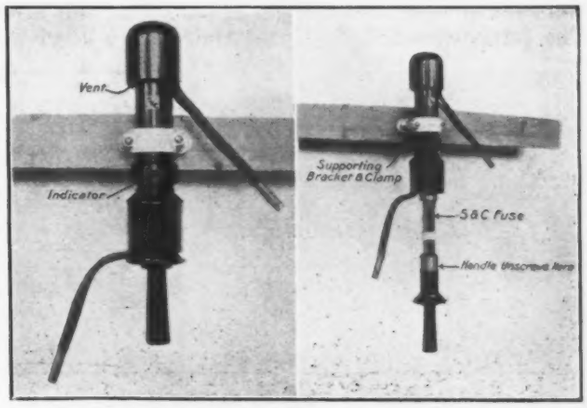
FIGS. 6, 7 AND 8—HOT-WATER KETTLE, CHAFING DISH AND TOASTER

equipped with 6 ft. of silk flexible cord and a seven-point contact terminal plug.

High-Potential Pole-Type Cut-Out

Schweitzer & Conrad, Inc., 1770 Berteau Avenue, Chicago, have recently adapted a high-potential fuse for use as a pole-type cut-out and have developed, they claim, a device which is simple and safe and can be handled at all times under the most unfavorable conditions. All live parts are protected, the fuse is locked in place before the circuit is closed, and gases freed when the fuse operates on short-circuit are directed upward and away from the operator through a vent in the top instead of in a downward direction. A positive indication of the condition of the fuse, it is asserted, can be obtained without disturbing the cut-out.

The fuse consists of a glass tube containing a spiral spring the lower end of which is connected to the bottom ferrule. The upper end of the spring connects to the fuse wire, which, passing through a liquid directer, is



FIGS. 1 AND 2—4400-VOLT, 200-AMP. POLE-TYPE CUT-OUT

connected to a short wire, which in turn is soldered to the cap on the top ferrule. The glass tube is filled with a non-inflammable liquid having a high dielectric strength about 250,000 volts per inch. When the fuse blows, the spring is released and instantly retracts, introducing a gap into which the liquid immediately rushes, thereby quenching the arc. The action is suffi-

ciently rapid, it is declared, to clear the trouble before synchronous apparatus is thrown out of step or circuit-breakers have time to open.

To make the fuse adaptable as a cut-out for pole use a casing has been designed in which the fuse is inserted, as shown in Fig. 1. This casing is made entirely of insulating material, which is unaffected by climatic conditions. A vent is introduced at the top, as shown in the illustration, to allow the escape of any gas that may form at the time the fuse operates on short-circuit, and also to prevent breathing and sweating due to atmospheric changes. A glass window, which is also shown in the illustration, on two sides of the cut-out, permits quick and easy inspection of the fuse without touching the cut-out or in any other way interfering with the continuity of energy supply.

To charge the cut-out the handle is screwed to the fuse as shown in Fig. 2, and the latter is inserted as far as it will go into the casing. The fuse is then given a turn and pushed in as far as it will go, when it is given one more turn. The first turn is made before the fuse closes the circuit and serves to prevent the fuse from falling out or being kicked out should a short-circuit exist at the time the circuit is actually closed.

The cut-out is being made in various sizes, that shown herewith having a rating of 200 amp. at 4400 volts. This cut-out takes fuses with ratings of from 1 amp. to 200 amp. While designed, primarily, for the protection of distributing transformers with high ratings, the cut-out is also well adapted for sectionalizing and isolating branch lines in time of trouble, for the protection of underground services fed from overhead networks, and as a fuse or disconnection in substations of the indoor or outdoor types such as are commonly served from rural lines. In cases where the cut-out is to be used as a disconnection only, instead of as a fuse, a "dummy" is employed to replace the fuse.

1916-Model Electric Passenger Cars

Some noteworthy changes and improvements have been made in the 1916-model electric passenger vehicles manufactured by the Anderson Electric Car Company, Detroit, Mich., and at the same time reductions in price ranging from $600 to $725 have been inaugurated. The company has adopted the one-chassis basis of production, and upon one chassis will be built four body styles. The forty-two-cell lead-battery equipment utilized with

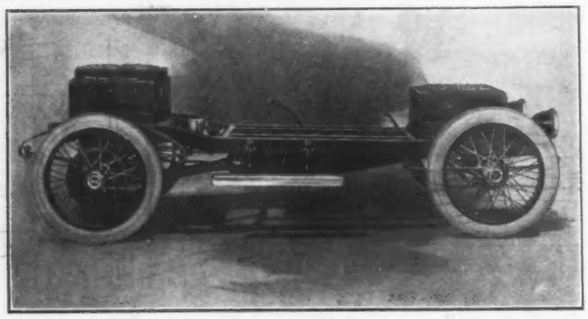


FIG. 1—SIDE VIEW OF CHASSIS SHOWING METHOD OF MOUNTING BATTERIES

the cars has been designed and will be made by the Anderson company. It consists of eight identical trays arranged lengthwise of the car. When the hoods are raised all the battery connections are outward and are easily accessible. The new 1916 battery will weigh at least 50 lb. less than the older types. In order to eliminate the vibration in the steering handle of the rear-drive cars, the idler bracket has been adopted and two short rods have been substituted for the long-reach rod.

Among the 1916-model cars being brought out by the Anderson Electric Car Company are the Model 61 four-passenger brougham, the Model 60 five-passenger duplex-drive brougham, the Model 59 five-passenger rear-

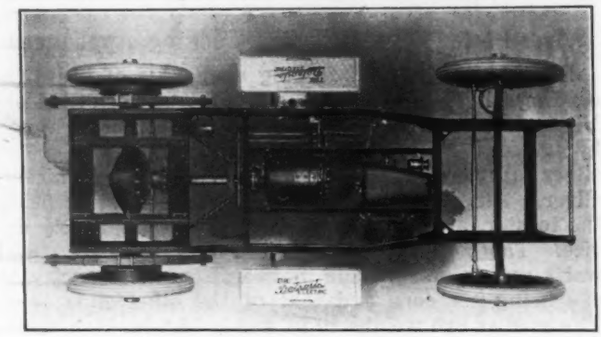


FIG. 2—VIEW LOOKING DOWN ON CHASSIS AND MOTOR

driven brougham of 100-in. wheelbase, the Model 58 five-passenger front-drive brougham, the Model 57 four-passenger rear-drive brougham and the Model 56 three-passenger cabriolet.

With the Model 61 four-passenger brougham two separate sets of brakes are utilized, either of which may be operated independently. The foot brakes are of the internal-expanding type, 14 in. by 2.5 in. in size, and operate on the rear hubs. Pressure on the left pedal not only applies the brakes but cuts off the power; pressure on the right pedal merely applies the brakes. The hand brake is of the electric type, operating on the motor, and is applied by a backward movement of the controller lever. Operating levers are mounted at the side of the rear seat, in parallel position, one above the other. The longer (steering) lever is operated by the right hand and the shorter (controller) bracket by the left hand. When leaving the car the levers may be turned out of the way and locked, thus preventing theft of the car. All parts of the body exposed to the weather are of aluminum. The wide rear seat of this car accommodates three people quite comfortably, and there is a fourth seat on a revolving Pullman chair in the front right corner. The equipment of the car includes headlamps, sashless side-door window lifts which raise and lower the windows by merely turning a knob, side-body lamps, two interior lamps, a tail-lamp, Weston volt-ammeter, Veeder odometer, alarm bell or horn, and worm type of gear.

The braking system of the Model 60 five-passenger brougham consists of two separate sets of brakes, one operating on the rear hubs, applied by pedal, and the other on the motor, applied by a backward movement of the control lever. The brakes may be operated from either the front or the rear driver's seat, either set being automatically locked when the other set is in use. A small pedal to the right of the foot-brake pedal operates the automatic cut-out switch when pushed backward. The wheelbase of the car is 100 in. The operating levers can be manipulated from either the front or the rear seat, two independent sets of parallel control levers being provided. In order to have one set of control levers in operating position, the other set must be folded flat against the side of the car and locked in that position; thus the possibility of tampering with the set not in use is prevented.

The Model 59 five-passenger rear-drive brougham is provided with a 100-in. wheelbase. Two separate sets of brakes are provided, operating independently. The

Model 58 five-passenger front-drive brougham has a wheelbase of 100 in. and is operated exclusively from the front Pullman chair. The Model 57 four-passenger rear-drive brougham has a wheelbase of 100 in. and its construction is similar to other types of broughams made by the Anderson company.

The Model 56 three-passenger cabriolet has been designed especially for use by business men. The car seats two people on the wide rear seat and one on the auxiliary front seat. The car is equipped with an adjustable top, which may be raised in inclement weather to protect the occupants of the car. The principles of construction and the equipment of the cabriolet are in accordance with the other 1916-model cars.

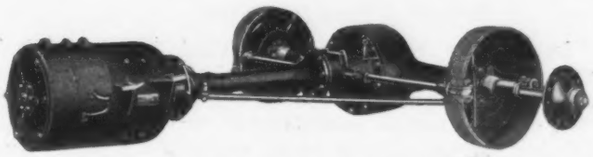


FIG. 3—MOTOR AND BRAKE ARRANGEMENT

Silvered-Mirror Reflectors for Flood Lighting

A silvered-mirrored reflector has been developed in which a special heat-resisting backing is employed to protect the silver reflecting surface from any possibility of becoming oxidized or tarnished owing to the action of the air at high temperatures. This reflector differs from all other reflectors made by the same company, the National X-Ray Reflector Company, Chicago, Ill., in that it is made without corrugations, which would be unsuited for the purpose. The reflector is designed for use with tungsten stereopticon lamps of 100-watt and 250-watt sizes, and when thus equipped gives a very high degree of concentration and at the same time produces a uniformly illuminated field. Various degrees of concentration may be secured by varying the distance of the lamp-base contact point from the neck of fixture. The distribution of light flux for two positions is shown in the accompanying illustrations, one of which shows the distribution of light flux when the lamp is forward in the reflector the maximum possible practical distance. If the lamp is moved further forward, a dark spot begins to appear at the center of the field. The design of the reflector is such that the light flux from the lamp in the zone 57 deg. to 110 deg. above the nadir is intercepted by the reflector, resulting in the reflection of approximately 50 per cent of the total light flux of the lamp in the main beam.

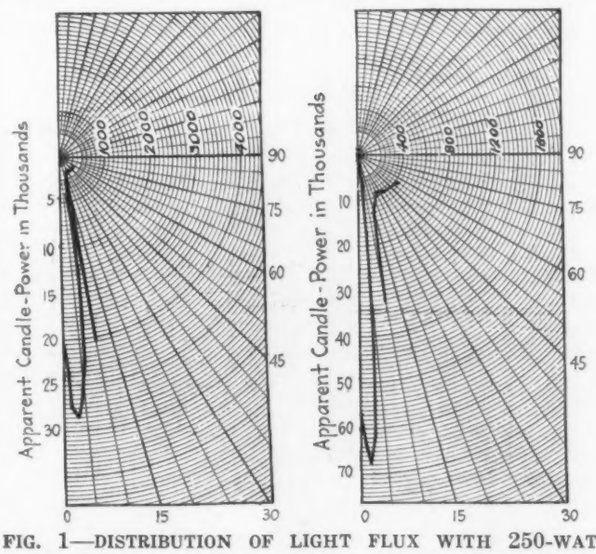


FIG. 1—DISTRIBUTION OF LIGHT FLUX WITH 250-WATT STEREOPTICON LAMPS, LAMP BASES 1 3/32 IN. AND 1 11/32 IN. BELOW REFLECTOR NECK

It is necessary for interior use to install this reflector within a weatherproof housing such as shown. Such a housing protects the lamp and keeps the reflector free from moisture and dirt deposits, for although the reflector backing itself is moisture-proof, the lamp and the glass crystal are not able to withstand moisture, rain and snow while in operation. This housing is provided with vent holes and a high-temperature annealed glass cover. The glass disk is held to be capable of withstanding sudden and extreme temperature changes. The external housing is made of brass enameled inside and outside. The reflector is adapted for use in the flood lighting of buildings, statues, etc., for illuminating signs and show windows, as well as for lighting swimming pools, stages, etc.

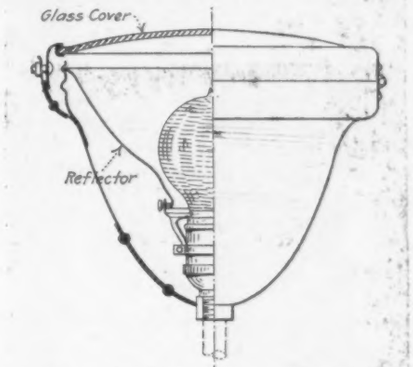


FIG. 2—FLOOD-LIGHTING UNIT, SHOWING PROTECTIVE HOOD

Composition Cord Connector

A cord connector of non-breakable composition material has just been placed on the market by the Chelten Electric Company, Philadelphia, Pa. The connector is small, neat and compact in design and is easily adjustable. The contacts are strong and heavy, the manufacturer points out, and are designed for considerable overload. The cap is interchangeable with composition receptacles and attachment plugs made by the above company.

CORD CONNECTOR OF NON-BREAKABLE COMPOSITION MATERIAL

Automatic Starters for Alternating-Current Motors

In the accompanying illustrations are shown two types of automatic starters recently developed for alternating-current motors operating on 110-volt to 550-volt, twenty-five-cycle to sixty-cycle systems. One of the starters

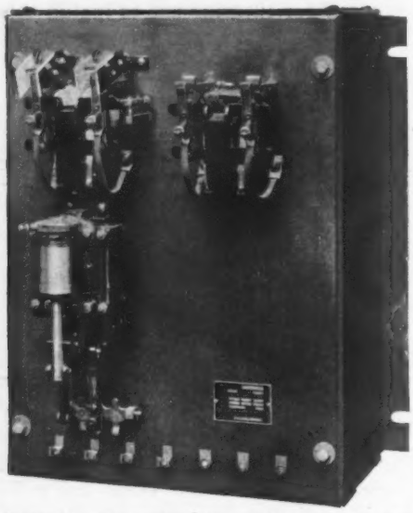


FIG. 1—STARTER FOR SQUIRREL-CAGE POLYPHASE OR SELF-STARTING SINGLE-PHASE MOTORS

(Fig. 1) is designed for use with single-phase, self-starting motors or polyphase squirrel-cage motors, a resistor being provided in the primary circuit of the motor to reduce the voltage for starting. Use is made of two double pole-magnet switches and a solenoid-operated timing relay. One of the switches is employed to connect the motor to the line through the resistor and the other to short-circuit the resistor after a definite time interval, which is determined by the setting of the relay.

The controller shown in Fig. 2 provides an automatic means for starting and stopping polyphase slip-ring motors driving pumps, compressors and similar ma-

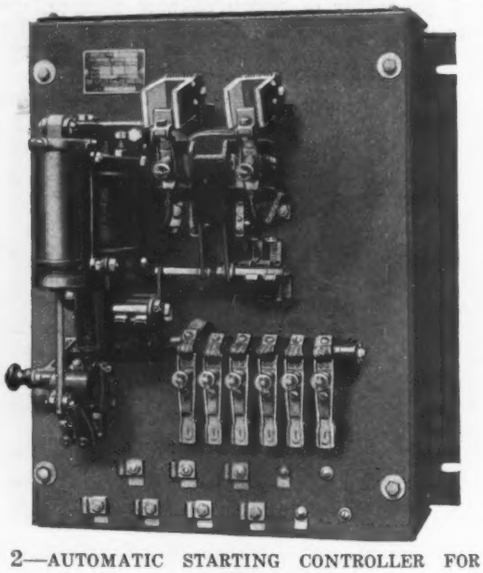
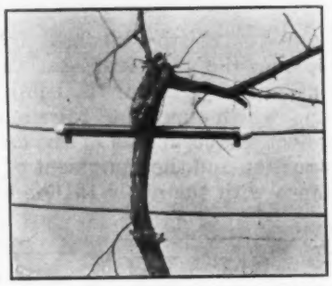


FIG. 2—AUTOMATIC STARTING CONTROLLER FOR POLY-PHASE SLIP-RING MOTORS

chines. A double pole-magnet switch with blow-outs is utilized for the primary current, while the secondary resistor is cut out of circuit and the motor accelerated by means of a multiple-finger, solenoid-operated rheostat. The automatic starters are particularly applicable to installations where the load is likely to vary between wide limits. Both types of controllers can be actuated by single-pole knife or snap switches, by float switches on open-tank pumping systems, or by pressure or vacuum regulators on closed systems. They are being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Tree Insulator

In order to prevent damage to shade trees and eliminate dangerous grounds, the insulator shown herewith has been developed for use on city transmission lines. The device consists essentially of two pieces of semi-tubular galvanized iron which are fitted together and



INSULATOR FOR PROTECTING SHADE TREES

held in place by circular screw clamps. The ends of the tube are equipped with porcelain insulators as shown. The insulator is being made in lengths of from 1 ft. to 6 ft. When over 1 ft. long, porcelain-mica insulators are inserted in the tube 1 ft. apart. The device is being made by the Frank Ridlon Company, Boston, Mass.

Electric Washer with Motor and Drive Wheel Under the Tub

An electrically operated washing machine of the stave-leg type, with a folding extension rack attached to the machine which folds back against the tub when not in

MOTOR-DRIVEN WASHER WITH INCLOSED GEARS OPERATING IN BATH OF OIL

use, is shown in the accompanying illustration. The "Blue Ribbon" machine, as it is called, is provided with gearing which is entirely inclosed. The gears run in a continuous bath of oil, oil being fed into the case by means of oil cups. Both the motor and the drive wheel are entirely under the tub, the wheel being guarded to

provide against accidents. The wringer can be set to work into and out of from two to four tubs; it can be moved back and forth any distance and locked securely at any desired position. The tub is of Virginia white cedar of 1.25-in. stock. It is provided with deep corrugations for facilitating the washing operation. The speed of the main drive shaft of the machine is 250 r.p.m. The washing machine is being placed on the market by the Haag Brothers Company, Peoria, Ill.

A Jack for Lifting Poles Without Digging Around Them

A tool for facilitating the removal of transmission-line and telephone poles from one location to another, or for removing them entirely, is shown herewith, as

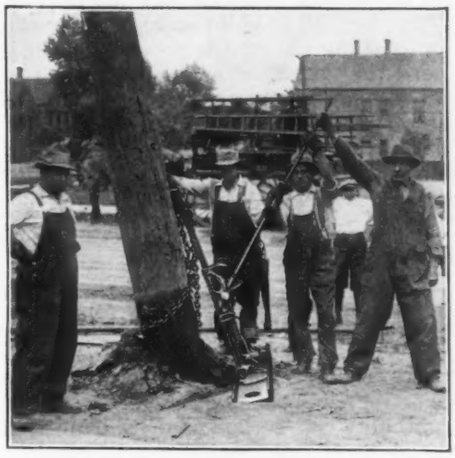


FIG. 1—JACK USED TO PULL OUT POLE WITH 5 FT. IN THE GROUND

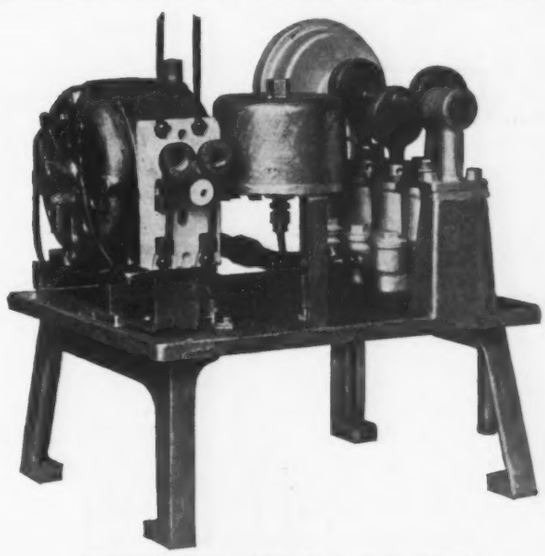
developed by Templeton, Kenly & Company, Chicago, Ill. With the No. 318 simplex pole jack, as it is called, digging around the pole is unnecessary for its removal.

FIG. 2—15-TON POLE JACK

The jack is single-acting and operates on the down stroke of the lever, tripping at any point desired. At the end of the total lift the cap may be dropped back to take a new hold on the pole. The capacity of the jack is 15 tons. It is 39 in. high and has a lift of 24 in. It pivots on its own base from 30 deg. to 90 deg. from the horizontal and follows, it is declared, the angle of the pole being pulled. The cap is recessed to hold the links of a chain firmly when they are dropped in position. A grab hook is attached to the chain which is of sufficient length to wrap once around a pole of average size. An I-beam-base support is provided which acts as a substantial foundation where the ground is soft or hollowed. The standard is a heavy malleable casting. All other parts are drop forgings. The double-lever socket insures a convenient position of the lever bar, it is asserted, with a jack at any angle. The complete weight of the jack, including chain and operating bar, is 127 lb. The jack is shown in operation in Fig. 1. The pole illustrated was about 5 ft. in the ground, had a large butt and was solidly embedded. With no preliminary digging the pole was removed in nineteen minutes.

Electrically Operated Pumping Outfit

Recently developed pumping apparatus of the triplex type for house service is shown in the accompanying illustration. The outfit, designated as No. 10 by the manufacturer, the Buckeye Pump & Manufacturing Company, Columbus, Ohio, has a capacity of 180 gal. per hour and is designed to pump against pressures of 25 lb. to 50 lb. per square inch. The over-all dimensions of the complete outfit are 17 in. by 13 in. by 12 in., and total weight is 100 lb. If desired, the apparatus can be



MOTOR-DRIVEN TRIPLEX HOUSE PUMP

mounted on the wall instead of the floor by means of brackets instead of the legs shown in the illustration. The plungers, which are self-lubricating, are of bronze and are driven by a cam shaft. Each cylinder is provided with independent suction and discharge check valves. Any obstruction becoming lodged under one check valve will, therefore, it is declared, not interfere with the operation of the other cylinders. The apparatus is operated by a 1/6-hp. direct-current or alternating-current motor as specified, made by the Robbins & Myers Company, Springfield, Ohio. The pump and motor are connected through a worm and spiral cut gear which operates in a tight grease-packed case. An automatic controller is utilized which places the motor in the circuit when the pressure in the tank falls to 25 lb. per square inch and opens the motor circuit when the pressure reaches 50 lb. per square inch. The outfit is equipped with a knife switch and fuse block, which are mounted in front of the motor on the base plate.

Small Electric Hand Lantern

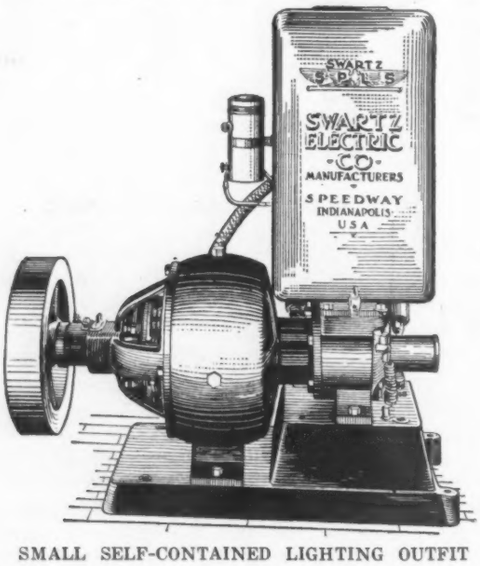
The accompanying illustration shows a novel electric lantern 6 in. high which has been developed by the Lincoln Electric Works, 112 West Adams Street, Chicago, Ill. The "Boy Scout" lantern, as it is called, is equipped with a small tungsten lamp and is operated by

SMALL BATTERY-OPERATED LANTERN

turning the screw shown in the illustration. It may be finished either in baked enamel or satin telephone finish. The globe may be of clear ribbed glass, plain clear glass, or of red, blue or green glass. A feature of this lantern is the small price. It sells for only 25 cents retail.

Small 32-Volt Lighting Plant

The Swartz Electric Company, Speedway, Indianapolis, Ind., has developed a small lighting plant consisting of a two-stroke-cycle gasoline engine of 2⅝-in. bore



SMALL SELF-CONTAINED LIGHTING OUTFIT

and 2.5-in. stroke, which is directly connected to a 0.5-kw., 32-volt direct-current generator. This plant is designed especially for use on the farm. It can be employed with or without a storage battery. The manufacturer directs attention to the fact that the outfit is simple, reliable and economical in operation.

Swivel Attachment Plug with Flexible Extension

To provide an easy attachment for portable electric appliances such as vacuum cleaners, etc., which because of the work required of them must be carried from room to room, and to avoid the necessity of removing glassware from fixtures, the swivel attachment plug shown herewith has recently been developed. To the swivel portion of the plug is added a flexible extension 5 in. in length. The hollow stem turns freely upon the

FLEXIBLE EXTENSION PLUG

cord, thus preventing twisting, and the flexible handle protects the cord at a point exposed to much wear. Means for gripping the cord is provided in the cap. In cases where the socket is slightly out of reach, the device can be conveniently used, as it increases the arm length some 5 in. The device is also useful where shades are too narrow or too deep for the hand to enter easily. The plug is being placed on the market by the Benjamin Electric Manufacturing Company, Chicago, Ill.

Electric Washer with Self-Adjusting Cylinder

The wooden washer shown in the accompanying illustration is operated by a small motor which is belt-connected to the large wheel. In case of trouble with the motor or service lines a wheel handle is provided so that the machine can be operated by hand if desired. The tub and all wooden parts are of Louisiana red cypress. A self-adjusting cylinder is utilized, making it possible to wash a large or small amount of clothing at one time. The lower rub-board is removable for cleaning purposes. No gears or breakable parts are employed. The bearings of the machine are practically noiseless, and the inside iron parts are rust-proof. The motor is so mounted that it can also be employed

MOTOR-DRIVEN WOODEN WASHER

for operating a churn, an ice-cream freezer, or any other small household appliance adapted for the purpose. The motor for operating the machine, the latter being made by the Boss Washing Machine Company, Cincinnati, Ohio, is manufactured by the Fort Wayne Electric Works.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

MANUFACTURER, JOBBER AND DEALER

Their Relations as Viewed from Three Angles Discussed at New England Contractors' Convention—The Functions of the Electrical Jobber—Better Merchandising Methods for the Dealer and Contractor

At the Springfield (Mass.) convention of New England electrical contractors, held on Sept. 22 and 23, 1915, an entire session was devoted to the presentation and discussion of papers on the relations between manufacturers, jobbers and dealers. Abstracts of these are given below.

From the Jobber's Standpoint

George J. Murphy, treasurer of the Pettingell-Andrews Company, Boston, Mass., read a paper stating that the electrical jobber is a necessity, since there are several hundred manufacturers in the industry who cannot profitably assume the burden of warehousing, selling and exploiting the small articles, as to size and cost, which form a large portion of an electrical stock. The chief functions of the electrical jobber are to purchase and stock in a suitable warehouse from 30,000 to 40,000 different articles, which must be assembled for quick distribution as ordered by his customers. This involves an expense before any material is sold of 6 per cent of the amount of stock carried in warehouse, as interest charges on this amount of capital. There is also a yearly charge of 5 per cent, representing deterioration from breakage, a large item, and from changing values in various lines of goods, owing to improvements and new insurance requirements. The wholesale electrical distributer must also furnish his customers with a catalog with price lists corrected to the ever-changing metal prices.

The jobber's most important task is the creation of a selling staff. Sales and advertising charges amount to from 25 to 30 per cent of the entire yearly expenditures. The jobber is closely in touch with the co-operative promotion of new articles, which opens an immense field for the development of sales by the contractor. There is one important policy adopted by the manufacturer and jobber which is at times misunderstood, and that is the elimination of the differential between the wholesale and retail price, and the substitution of the principle of quantity prices, graded from less than carton to standard package of maximum-quantity purchases. These graded discounts take into consideration the benefits derived from the volume of the order as a factor in increasing their sales and moving their merchandise, and make allowance for the additional warehouse and clerical cost for handling the smaller unit shipment. The difference between the maximum and minimum discounts on any class of material has been carefully defined, and every jobber or contractor buys at an equitable cost, based on his working capital and the requirements of his trade.

Standard-Package and Broken-Package Prices

In other words, the contractor or buyer, who in turn places with the jobber a standard package order, assumes the risk and expense of such merchandise investment and receives a protective margin in his cost over his competitor who buys only a smaller quantity. This contractor, adopting the broken-package prices of the jobber, finds a sufficient margin of profit to permit him to resell to his local trade. The contractor can and should sell to the various manufacturing plants and local firms in his town, but in order to resell at a profit should buy of the jobber in standard packages and incur the expense of stocking this material. The jobber is forced to warehouse goods in large quantities and sell in smaller amounts, and this principle applies equally to the contractor seeking to merchandise electrical goods to local concerns. Improvements in the methods and devices for the installation of electric service, and in particular the more artistic designs of fixtures, afford splendid talking points for the electrical contractor and dealer with which to approach the owners of old installations and point out the advantages of more modern outlet arrangements and the pleasures of a more up-to-date lighting scheme, thus supplementing the loss of business through the gradual wiring of old houses. The manufacturer should sell his products only through firms who carry out the functions of a wholesale distributer by employing sufficient capital actually to warehouse and properly sell his goods. The jobber, in turn, must exact certain requirements and have certain known standards by which he recognizes a firm entitled to the consideration and prices of a contractor. He cannot create, as in the past, damaging competition by selling to every business firm and boy who style themselves electrical contractors with only a business card as evidence. The contractors can do their share by eliminating every so-called jobber and commission firm whose acts and principles appear to be of destructive character.

From the Contractor's Viewpoint

A paper by Arthur J. Newell, an electrical contractor of Holyoke, Mass., frankly discussed cases of price discrimination which had caused trouble in the relations between jobbers and contractors. Most of the difficulty was due to the sending of lower quotations by jobbers directly to contractors' customers, to marking the wholesale prices on bills sent by a consumer to the jobbing house, to extension of credit to unsuitable firms, and to soliciting the contractor's customers directly. The author pointed out that the contractor should meet these conditions by improving his credit through making sure that every contract taken is secured at a price showing a profit, necessitating more careful estimating and a better system of keeping costs. Prompt payment of bills is another point. The contractor should if necessary borrow from his banker in order to pay his bills, so that bills can be discounted where this is allowed and all others repaid in thirty days. The contractor should learn to borrow from the banks rather than from the jobber in the form of extended credit. More attention should be given to the appearance of the contractor's place of business, studying the art of show-window dressing, co-operating with the central station in the sale of motors and appliances, and avoiding lines of merchandise in which the margin of profit allowed the dealer is too small. The author recommended refusing to do business with any jobber who sells to the contractor's legitimate customers. In closing, the paper

expressed the view that the jobber is no longer a necessity to the industry, advocating direct orders to the factory and the establishment of a committee to which cases of improper treatment can be referred.

From the Manufacturer's Side

W. F. Abely, sales manager Western Electric Company, Boston, Mass., presented a paper emphasizing the importance of building up a reputation in the contracting business by carrying accepted standards of material and equipment. A concern always pushing standard lines becomes identified in the customer's mind with such standards. Concerns handling cheap products at low prices are frequently changing from one to the other, with the result that customers are never sure of what they are going to get or whether or not the quality will be satisfactory. The contractor's merchandise investment is also affected by varied materials, also his ability to "match up" parts or to send out a man on a repair job with the confidence that the right article is being carried the first time. If the contractor does not have a fixed policy of buying only accepted standards, the price he gets for the cheaper substitutes is of no advantage to him unless he has a monopoly on that particular price, which has never yet occurred. Usually no greater percentage of profit is made in handling cheap goods than in carrying standard products. The contractor should strive to sell, not the cheapest articles, but those which bring the highest prices and are of the best-known quality.

Discussion

The foregoing papers were discussed by H. F. Haskell, Holyoke, Mass.; J. O. Morris, Hartford, Conn.; Joseph E. Green, Boston; John J. Collins, Springfield, Mass.; F. L. Barnes, Boston, and J. C. Coghlin, Worcester, Mass. Mr. Green, as an independent jobber with previous contracting experience, asserted his belief in the policy of buying from the manufacturer and distributing only through the contractor. He issues no catalog. Mr. Collins advocated publishing a list of agents in the jobber's catalog and sending discount sheets separately to the accredited contractors. Mr. Murphy said that no special privileges are accorded the jobber by the manufacturer, who merely gives a fair and reasonable price for marketing the products. The jobber must carry certain special lines in order to keep down his investment, to get better relations with the manufacturer, and to secure a better turn-over. In such cases stock can be returned to the manufacturer with a better allowance in case of improvements. The resale policy of the jobber does not prevent the contractor's getting the business. A committee, consisting of the following representatives of the manufacturing, contracting and jobbing interests, was then appointed for the purpose of reporting next year on means of improving relations: W. F. Abely, Boston; W. H. Hoppin, New Haven, Conn.; J. E. Green, Boston; George J. Murphy, Boston; Henry D. Temple, Worcester, Mass.; P. C. Fitzpatrick, Springfield, Mass., and E. M. Baldwin, Hartford, Conn.

Resolution on Contract Electrical Work

The convention passed a resolution favoring letting separate contracts for electrical work in building construction, taking up details with the owner or architect, eliminating the percentage added by the general contractor to his bid, and getting away from the tendency toward accepting the lowest bidder without regard to anything except price. Passing inspection is frequently the sole interest of the lowest bidder. Where electrical contracts are included in others, the estimates are usually hurried, inaccurate and unduly low.

Meetings of Important N. E. L. A. Committees at New York During Week

During the past week many of the standing committees of the National Electric Light Association met in New York headquarters for organization. On Tuesday the "Salesman's Handbook" committee met to discuss the revision of some of the sections of the handbook, and on the same day the committee on the education of salesmen also was in session. The latter committee reported that it had then 600 applications for the course which will begin on Nov. 1. The aim is to get 1000 persons to take the seventeen lessons of the course. The tuition is $12, and the course is to be given by correspondence supplemented where possible by local class meetings.

The publications committee of the Commercial Section met on Wednesday morning and decided on the revision of some of the publications. A new booklet appropriate for the Christmas season will be published shortly, and it is confidently expected that the sale will reach over 200,000. There was also a meeting of the committee having in hand the proposed code of the Bureau of Standards, of which W. H. Blood, Jr., of Boston is chairman. On Friday the executive committee of the association held an all-day session for the discussion of important association matters.

New York City's Electrical Licensing Board a Representative Body

Pursuant to Chapter 9 of the Code of Ordinances of the City of New York, Commissioner William Williams of the Department of Water Supply, Gas and Electricity has appointed the following persons members of the board to determine the fitness of applicants for licenses for installing and repairing electrical wiring and appliances for light, heat and power in buildings: Hubert S. Wynkoop, chairman, electrical engineer, Bureau of Gas and Electricity, Municipal Building, Manhattan; John P. Ryan, electrical contractor; Paul McNally, journeyman electrician; Joseph C. Forsyth, electrical inspector; Arthur A. Pope, electrician in employ of New York Edison Company; Fred G. Webber, practical builder, and Elmer D. Coulter, real-estate owner.

This board will proceed at once with the formulation of rules governing the issuance of licenses. These rules, when approved by the commissioner, will be published.

Telephonic Serenade Across Continent Taken Part in by Thousands of Utility Employees

A chorus of nearly 5000 employees of the New England Telephone & Telegraph Company, gathered in Mechanics' Hall, Boston, Mass., on Sept. 27, sang "America" to an audience of several thousand employees of the Pacific Telephone & Telegraph Company at the San Francisco Exposition. As soon as the applause on the "Coast" subsided the Californians responded with the "Star-Spangled Banner" and in turn were cheered to the echo. The occasion was a special "demonstration night" arranged by the officials of the two companies, and a forty-piece orchestra on the Boston stage supplemented the voices of the great gathering. A special loud-speaking transmitter was used, and 2500 telephone receivers, allowing one to every alternate chair, were installed to enable the audience to hear the interchange of greetings and song. Addresses were given by officers of each company, and the occasion did much to emphasize solidarity of interest among the employees.

Per Capita Consumption East and West.—President Henry I. Harriman of the Connecticut River Transmission Company, Boston, Mass., is authority for the statement that New England central-station customers call for only 200 kw.-hr. per year per capita, whereas the average consumption is 450 kw.-hr. in the Middle West and from 500 kw.-hr. to 740 kw.-hr. on the Pacific Coast.

Twentieth-Century Ways Suit Athenians.—A new office and supply store has been opened by the Athens Electric Company, of Athens, Ohio, for the double purpose of facilitating the payment of bills and the sale of electrical appliances. A full stock of energy-consuming devices for domestic use will be installed for demonstration and sale, and house-wiring estimates will also be furnished through this office on request.

Examination for Electrical Draftsmen.—The United States Civil Service Commission announces an open examination for electrical draftsmen, Nov. 3 and 4, to fill vacancies in the Navy Department at Washington, at a beginning salary of $4 per day. The duties of the position require originating and supervising the preparation of plans for electric plants, installation plans for ships, tower lighting and interior communication, the design of switchboards, etc.

Zinc Plant to Use 10,000 Hp.—The new zinc plant of the Consolidated Mining & Smelting Company, Toronto, Canada, the metallurgists of which have discovered a satisfactory process for reducing ores electrochemically, will be constructed with a capacity of 10,000 electric hp. Energy for this service will be furnished by the West Kootenay Power Company. This plant, which will be at Trail, British Columbia, it is expected, will be producing 25 tons of spelter daily before the end of the year.

An Electric Shower for the Bride-Elect.—One of Cleveland's young ladies upon the announcement of her engagement was tendered, instead of the customary linen shower, an "electric" shower. The garden where the guests gathered was tastefully decorated with electric Japanese lanterns, which were strung among the trees. An electrically cooked supper was served. Among the electrical devices presented to the bride-to-be were a coffee percolator, a toaster, a grill, an electric iron, a hair drier, a tea urn and a table lamp.

Banquet Cigars by Electric Express.—S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, was the host at a unique dinner to local newspaper men Sept. 24, at which each guest cooked his own steak on an electric grill. Besides the meat there were baked potatoes, boiled corn, coffee and pie, all cooked by electricity. Then over a track on the table came an electrically propelled train bearing cigars, cigarettes and matches. Following the meal Mr. Way explained the welfare work being done for employees by the company.

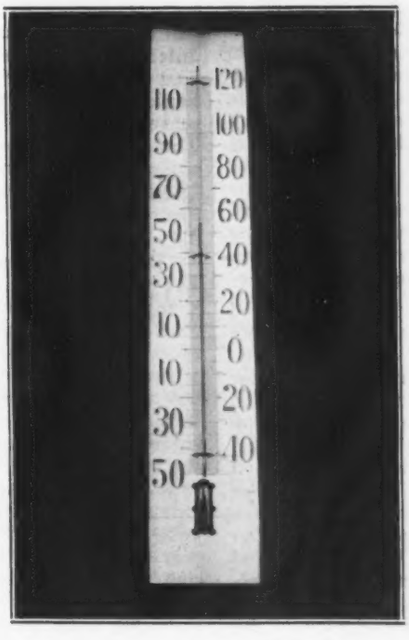
Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

Ohio Company Voluntarily Reduces Commercial Rates.—Pending the action of the Ohio Supreme Court on the question of jurisdiction which was raised when the new contract between the city and the company was taken up by the State Public Utilities Commission at the request of a number of Marysville citizens, the Marysville Light & Water Company has voluntarily reduced its rate on commercial lighting. In case the court decision should be against the company, several serious obstacles and extra clerical work will be avoided by this course.

Exposition Grounds to Become Playground for Electric Employees.—John A. Britton, vice-president of the Pacific Gas & Electric Company, San Francisco, Cal., has announced that that portion of the grounds now occupied by the Panama-Pacific International Exposition which is owned by the Pacific Gas & Electric Company, consisting of several blocks at the Fillmore Street entrance to the grounds, will be made into a playground and recreation field for the 2500 employees of the Pacific company. The future recreation grounds will include a baseball field, a football gridiron, a tennis court, and many other provisions for employees' athletics.

A Huge Illuminated Thermometer at Kansas City.—An electrically lighted thermometer 9 ft. in height is a feature of the office building of the Kansas City Electric Light Company, and nightly indicates the temperature to passengers in street cars and automobiles out in the roadway, as well as to pedestrians on the sidewalk. The glass background of the huge instrument is illuminated by fourteen 25-watt tubular lamps so arranged that their heat does not affect the proper expansion and contraction of the indicating mercury column.



A 9-FT. ELECTRIC-LIGHTED THERMOMETER AT KANSAS CITY

A Case Where Electric Drive Averted a Strike.—In a New England mill the weave-room of which had been operated for some months by central-station service, with motors leased from the local electric company, the owners proposed to utilize waterwheel mechanical drive, holding in reserve the electrical service from outside. When the weavers, who were paid by the piece, heard of the plan they threatened to strike because of the diminished production expected. Upon investigation, therefore, the owners quickly decided to continue to operate with electricity from the central station and industrial peace was again restored.

Setting Microphones to Catch Zeppelins.—Edward F. Chandler, inventor of a system of harbor defense now being tested by the United States Navy, has proposed a scheme for detecting the approach and direction of travel of Zeppelins and other hostile air craft when the airships are themselves lost to view in clouds and mist. Mr. Chandler's plan contemplates the use of a number of sensitive microphones, installed at fixed positions about the station to be protected, through which an observer at a central point can listen to and compare the sound of the airship's propellers as heard through the different transmitters. In this way, declares the inventor, the height, speed, range and direction of the Zeppelin could be easily determined and a counter-attack prepared before the airship manifested its position by dropping bombs or coming into open view.

An Electric Ferry Run by Trolley.—An electrically operated ferry at Strassburg, Germany, receives its energy from an overhead-trolley conductor. The boat is a flat raft, 45 ft. long, with 20-ft. beam, having a deckhouse on one side in which are installed the motor, control gear, gearing, etc. Resting on the bed of the lake is a ⅝-in. galvanized-steel rope which passes around a 3-ft. hauling drum on the boat, and which also constitutes the return conductor for the trolley circuit. The motor drives this drum through two belts and a countershaft. The positive conductor is an ordinary trolley wire of hard-drawn copper 9 mm. in diameter, stretched between two 30-ft. lattice masts, one on each side of the lake. Connection between the trolley wire and the boat is made by means of a collector consisting of a single light over-running wheel attached to the raft by a flexible insulated copper cable, the slack of which is taken up by an ingenious arrangement of hanging weights and pulleys suspended from loops in the cables.

Associations and Societies

Philadelphia Jovians Rejuvenate.—The Philadelphia (Pa.) Jovian League held a rejuvenation on Oct. 8 at the Hotel Adelphia. Walter H. Johnson, vice-president of the Philadelphia Electric Company, outlined the plans for Electrical Prosperity Week. Harry Kepler also addressed the meeting.

Kansas Utilities Association at Topeka.—The annual convention of the Kansas Gas, Water, Electric Light and Street Railway Association will be held at Topeka, Kan., Oct. 21, 22 and 23. Among the men prominent in Kansas public-utility management who are expected to deliver papers are Albert Newman of the Kansas Gas & Electric Company, Arkansas City; W. R. Murrow, Independence; P. J. Long, Topeka; W. A. Scothorne, Junction City, and C. B. Jacks, Salina. The evening of Oct. 22 has been set aside for the Jovian rejuvenation, which will be conducted by a Wichita team.

United States Military Telegraph Corps Annual Reunion.—The annual reunion of the Society of the United States Military Telegraph Corps will be held at the Broadway Central Hotel, New York City, on Oct. 13 and 14. Following the banquet on the opening night, D. H. Bates, secretary of the society, will throw on the screen a reproduction of the first telegraph message sent, May 24, 1844, with Professor Morse's autograph certificate. The owner of the original tape message, Mrs. George Innes, daughter of Annie Ellsworth, who sent the first message, will be present, together with Professor Morse's son Edward. There will also be exhibited pictures of civil war scenes related to the telegraph corps, including war-time and more recent photographs of prominent members of the corps.

Chicago E. V. A. Elects Officers.—At the fourth annual meeting and dinner of the Chicago Section of the Electric Vehicle Association of America, held at the Hotel La Salle on Oct. 5, the following officers were elected for the ensuing year: Chairman, George B. Foster, assistant to the vice-president Commonwealth Edison Company; vice-chairman, W. F. Bauer, Chicago manager for the Edison Storage Battery Company; secretary-treasurer, F. E. McCall, electric-vehicle engineer of the Commonwealth Edison Company; executive committee, D. M. Simpson, Western manager for the General Lead Battery Company; Gail Reed, manager of the passenger-car department of the Walker Vehicle Company; A. J. Brechtel of the General Vehicle Company, and W. C. McNitt, owner of the Hollywood Garage.

The Avo Club, Carnegie Institute, Pittsburgh, Pa.—The Avo Club of the School of Applied Industries, Carnegie Institute of Technology, Pittsburgh, Pa., is planning a special program for the celebration of Edison Day. The club is composed of students in the electrical courses, its object being to promote interest in electrical work and to bring the men together socially. The custom of celebrating Edison Day in the school was inaugurated last year by the electrical equipment department and was very successful. This year papers will be read on appropriate subjects by members of the club, and liberal use will be made of stereopticon views and possibly of motion pictures. Models of Edison's early inventions as well as of some modern ones will be shown. The club also expects to prepare a program for Prosperity Week during November.

Philadelphia A. I. E. E. Meeting.—The 313th meeting of the American Institute of Electrical Engineers will be held at the Engineering Building, University of Pennsylvania, Thirty-third and Locust Streets, Philadelphia, Oct. 11, under the auspices of the Philadelphia Section of the power-station committee. The papers presented at the afternoon session will be "Supplemental Power for Hydroelectric Systems," by J. F. Vaughan, and "Combined Operation of Steam and Hydraulic Power in the Pennsylvania Water and Power Company System," by John Abbet Walls. Immediately after the session there will be a visit to the new generating station of the Philadelphia Electric Company at Twenty-sixth and Christian Streets. A dinner at the Normandie will be followed by an evening session, at which a paper on "Construction Elements of the Tallulah Falls Development," by Charles G. Adsit, assisted by W. P. Hammond, will be presented.

Public Service Commission News

Massachusetts Commission

The commission gave a hearing on Sept. 30 relative to the status of the sliding-scale agreement between the State and the Boston Consolidated Gas Company, anticipating a report to the next Legislature upon the desirability of continuing the agreement for another ten years. President J. L. Richards of the company appeared before the board and explained that under the agreement dividends have been increased while the price has dropped from $1 to 80 cents per 1000 cu. ft. and $420,000 has been paid to employees through a profit-sharing system. The cost of manufacture has been reduced from 57.11 cents per 1000 cu. ft. in 1906 to 49.11 cents in 1915. President Richards said that the company could not reduce the price to 70 or 75 cents and maintain the dividends allowed by law. The board will consider whether the scale should be applied to other cities besides Boston. L. W. E. Kimball of the Independent Brotherhood of Electrical Workers, Boston, opposed the sliding scale.

The Western Union Telegraph Company and the United Telegram Company have petitioned the Massachusetts Supreme Court to annul the recent decision of the commission requiring them to supply stock-ticker service to Calvin H. Foster, a Boston broker. The petitioners contend that the Interstate Commerce Commission is the proper adjudicator of the case and that to comply with the board's order it would be necessary to appropriate the property of the New York Stock Exchange for the benefit of Foster and thereby destroy their contracts with the exchange.

California Commission

The commission has issued a first supplemental opinion to its decision of May 17, 1915, in its investigation, upon its own initiative, into the financial condition of the United Railroads of San Francisco, postponing the beginning of the depreciation fund of $550,000 a year. The original order provided that the depreciation account should be established so as to show an appropriation from earnings of $550,000 not later than June 30, 1915. This amount was to accrue in equal monthly installments of $45,833.33. Provision was also made whereby $300,000 of this sum should be used for certain specified purposes and the balance of $250,000 a year should be used by the railroads for expenses of betterments and repairs. The railroad applied for a rehearing, but the commission found no merit in its contentions.

The commission has rendered a decision denying the application of the Wells-Fargo Express Company, the American Express Company and the Great Northern Express Company to increase their rates within the State of California. The raise sought was that authorized by the Interstate Commerce Commission on interstate business. The application for the increase, as presented by the companies, would, if granted, give them a profit of something more than 36 per cent upon the value of their property. The commission regarded this as unreasonable and considered that the companies should be content with a profit in excess of 22 per cent upon their property.

New York Commission

The Public Service Commission of the Second District has rendered a decision in the long-pending Lockport interchange case and has ordered the New York Central Railroad and the International Railway to provide facilities for the switching of freight between the two roads in the city of Lockport. This it did in the public interest. Speaking of the unwillingness of the railroads to grant this interchange through fear that one or the other may gain an advantage not now existent in the handling of the Lockport business, the opinion says: "The underlying theory of the respondents as to their freight service in Lockport seems to be the maintenance of competition, while the complainants seek to invoke the more modern theory of regulation. . . . However this may be, it now becomes the duty of the commission, regardless of what has gone before, to make a declaration of the rights and obligations of both shippers and railroads with reference to these matters, and in such declaration to show, if possible, that the interests of the parties are mutual and not antagonistic; and if we can do

that we have gone a long way toward proving the efficacy of regulation of common carriers in the interest of the public and for the benefit also of the carriers themselves.

"Both carriers seem to forget that they have no prescriptive right to the freight business at Lockport but are only common carriers who may or may not be employed to transport such freight and that the shippers have something to say as to which railroad the business belongs to."

Indiana Commission

The Public Service Commission of Indiana has granted authority to Tell City to furnish electricity to Dehaven and McIntyre from the municipally owned plant at Tell City, for the use of the town of Troy, the energy to be measured at the city's master meter at the north corporation line of the town of Troy. The petition asks authority to charge a rate of 5 cents per kilowatt-hour for all energy furnished the private contractors, but the commission's order reads that the rate shall "be subject to the regulations authorized by law." The contract will run ten years.

A suit has been filed at Logansport to test the validity of the Indiana utility statute. The plaintiff, M. Winfield, a lawyer, charges that the commission exceeded its powers in increasing the rates of the Logansport Home Telephone Company above the rates fixed when the company took a franchise from the city. The complaint further contends that the telephone company cannot legally surrender its franchise, as provided by the utility law, and that the commission cannot take over the powers of the city in the matter of fixing rates for public utilities. The complaint contends that the utility act is unconstitutional in Indiana because it tends to impair the validity of a contract. The commission recently granted to the Logansport Home Telephone Company an increase in rates (ELECTRICAL WORLD, Aug. 28) on a showing of insufficient earnings to pay proper return on the investment and keep up a proper depreciation fund. The telephone company thereupon offered to sell the property to the city at the value placed on it by the appraisers for the commission.

Ohio Commission

The hearing before the commission of the Cleveland Electric Illuminating Company's appeal from a city ordinance requiring it to extend its steam-heating mains to the new City Hall in Cleveland was completed on Sept. 21. Attorneys for the company presented an affidavit from Samuel F. Haserot which stated that Mayor Newton D. Baker had told him that the company would not be permitted to extend its heating mains to the new Haserot Building on Huron Road until it complies with the ordinance requiring it to extend its mains on East Sixth Street to the new City Hall. Mayor Baker admitted that he had made such a statement to Mr. Haserot. He denied the reported statement that he would use the police force to tear out the company's mains if it does not come to terms, but said that if he had the power he would not only have this done but would get down in the trenches and help do it. John Wolf, mechanical engineer for the company, testified that it would be impracticable to tap either the Superior Avenue or the Euclid Avenue mains, since the building would require 42,000 lb. of steam heat per hour, and this could not be piped from either of these mains. Light and Heat Commissioner Ballard asserted that the building would require but 21,000 lb. of steam heat per hour. Several witnesses for the company testified that an investment of about $100,000 would be required to lay the necessary mains from the plant to the City Hall building. Arguments of attorneys were presented on Sept. 22. The company asked that the terms of the franchise be declared unreasonable and the city requested the commission to name reasonable terms in case it finds the terms and rates included in the present franchise unreasonable. The commission has selected the following men to conduct a civil service examination for an expert electric engineer for the department: F. C. Caldwell, head of the electric engineering department of the Ohio State University; Henry B. Dates, professor of electrical engineering in the Case School of Applied Science at Cleveland, and A. M. Wilson, head of the electrical engineering department of the University of Cincinnati. A law passed last winter vacated the position held by L. G. White, and he has for some time been serving as a provisional appointee. The examination will take place on Oct. 6.

Corporate and Financial

Consolidated Electric Company, San Francisco, Cal.—The California Railroad Commission has issued a supplemental order approving an agreement between the Consolidated Electric Company, the Great Western Power Company, the Anglo-California Trust Company and the prospective purchasers of the general mortgage bonds of the Consolidated company, to exchange the bonds of the United Light & Power Company of California and the three-year collateral-trust gold notes of the United Light & Power Company of New Jersey for bonds of the Consolidated company to be placed in trust with the Anglo-California Trust Company. The Consolidated company at the same time shall issue the bonds to the depositors. The agreement also gives power to the Consolidated company to clear the properties from liens.

Consolidated Gas, Electric Light & Power Company of Baltimore, Md.—Recent marked improvements in business conditions in Baltimore will probably continue and be reflected in the income of the company during the ensuing fiscal year, according to the annual report of the company for the year ended June 30, 1915. The gross income for the year shows an increase over the previous fiscal year of $388,506, or 6.1 per cent, and the net earnings an increase of $145,744, or 4.8 per cent. The sales of both gas and electricity showed satisfactory increases. The widespread business and financial depression during the year merely had the effect of slightly retarding the normal growth of the company's business. The gross income from gas sales increased $124,713, or 3.8 per cent, and the gross income from electric sales increased $227,261, or 7.4 per cent. Improvements and betterments completed during the year and in course of completion amounted to $1,110,594.87. The growth in the electric operations is shown in the following comparison:

	1914	1915	Per Cent Inc.
Gross income from sale of electricity	$3,073,938	$3,301,200	7.4
Kilowatt-hours sold	123,837,695	126,933,209	2.5
Customers	34,330	38,419	11.9

In the amount of electricity sold the actual gain in general business was 17 per cent as compared with that shown above, this real improvement in the company's output being apparent upon the elimination from the output of both years of a certain very limited number of large consumers whose requirements decreased during the year owing to the fact that their products had heretofore been produced largely for export. These same consumers are, however, finding home markets for their products and are rapidly approaching their normal requirements for electricity. During the year there has been an increasing demand from the industries of Baltimore for electric motive power, and the company closed contracts during the year for large industrial and general power purposes, aggregating 16,817 hp., this being over 12 per cent greater than the amount contracted for during the previous year and next to the largest amount obtained in any one year of the company's history. The equipment in several substations has been added to, and the electric lines have been extended to serve many districts of the city better and to provide for the new business secured. Approximately 100 miles of cable were added to the underground distribution system. The appliance and merchandise business was vigorously advanced. The sale of electrical devices and accessories amounted to $400,353, and the sale of gas-consuming devices and accessories amounted to $422,131, a total of $822,484. In concluding the report President H. A. Wagner makes the following statement with regard to the company's policies: "As has been stated in the past, the company's policies include the consideration of the public's interests from every standpoint, the mutualizing of the interests of the company, its consumers and its employees through stock ownership, the rendering of the best possible service at the lowest rates consistent therewith, and sharing with the public in the form of rate reductions from time to time the increased prosperity of the company, resulting from the development of its business. These policies and the company's active efforts in the line of co-operation have brought greater fruits this past year than ever before, as evidenced particularly by its recent adoption of the lowest fair rates and its success in distributing its shares among

its consumers." A comparative statement of income and output for the years ended June 30, 1914 and 1915, follows:

	June 30, 1914	June 30, 1915
Gross income	$6,400,896	$6,789,401
Operating expenses and taxes	*3,333,821	*3,576,583
Net earnings	$3,067,075	$3,212,818
Fixed charges	1,567,689	1,640,361
Net income	$1,499,386	$1,572,457
Dividends paid and payable	891,562	1,064,629
Surplus	$607,824	$507,828
Reserve for depreciation, amortization, etc..	460,000	460,000
Balance	$147,824	$47,828
Special reserve for new-business campaign and extraordinary expenses	125,000	.....
Net surplus	$22,824	$47,828

*Does not include new-business and extraordinary expenses amounting to $300,000 for 1914 and $125,000 for 1915, charged to "special reserve for new-business campaign and extraordinary expenses."

Since the beginning of the plan some four months ago to sell stock to customers more than 840 gas and electric consumers have been added to the list of stockholders. The average number of shares subscribed for per customer was between four and five. Subscriptions continue to come in, and many more customers are expected to take advantage of the opportunity.

Eastern Pennsylvania Railway Company, Pottsville, Pa.—During the year ended June 30, 1915, the company added 725 new customers to its lines, according to its annual report. The earnings of the electric department increased $26,609, or 9.82 per cent. A comparative earnings statement shows the following revenues for the years ended June 30, 1914 and 1915:

	1914	1915
Gross earnings	$826,416	$825,455
Operating expenses and taxes	503,488	486,570
Net earnings	$322,928	$338,885
Fixed charges (all companies)	244,019	227,783
Surplus	$98,909	$111,102

Long Island Lighting Company, New York, N. Y.—The Public Service Commission for the Second District of New York has authorized the company to issue $135,000 of 5 per cent bonds at 87.5 and $66,000 of common stock at par to provide funds for improvements and additions.

Manchester (N. H.) Traction, Light & Power Company.—For the year ended July 31, 1915, the company shows the following earnings:

	1915	1914
Gross earnings	$1,330,624	$1,308,542
Operating expenses and taxes	770,028	767,783
Net earnings	$560,596	$540,759
Interest charges	143,892	144,569
Balance	$416,704	$396,190
Bond sinking fund	3,000	3,000
Balance (for reserves, depreciation and dividends)	$413,704	$393,190

Midland Counties Public Service Corporation, San Luis Obispo, Cal.—The California Railroad Commission has authorized the company to renew four promissory notes amounting to $9,218.64 to electric and engineering companies for construction and improvements of a plant. The term of the notes shall not exceed one year from Dec 31, 1915.

Northern Ohio Traction & Light Company, Akron, Ohio.—Notwithstanding the jitney bus competition, which has adversely affected the earnings of the company, the revenue from the electric light and power business has been growing at such a rate as to entirely overcome the decrease in gross and net receipts reported in the earlier months of the year. In July the gross receipts increased $20,000 over July, 1914. The surplus, after all fixed charges, was $100,228, as compared with $94,641 for the preceding year, a gain of $5,587. The earnings for the first seven months of the calendar year compared with last year follow:

	1915	1914
Gross earnings	$2,128,388	$2,073,359
Operating expenses and taxes	1,321,350	1,265,805
Net earnings	$807,038	$807,554
Interest	360,270	352,683
Surplus	$446,768	$454,871

Shawinigan Water & Power Company, Shawinigan Falls, Quebec, Canada.—The unusual conditions brought about by the European war have affected the operation of the company neither disastrously nor favorably. Its output, which has reached the point of maximum production, is contracted for by industries which are manufacturing necessities and which therefore continue to operate in spite of a general business depression. Its subsidiary, the Cedar Rapids Manufacturing & Power Company, is operating under contracts which call for the utilization of 83,000 hp. of its generating equipment. An additional contract for 10,000 hp. calls for delivery on Jan. 1. This will leave but 6000 hp. of the initial development of this plant not under contract.

Manufacturing and Industrial

The Usona Manufacturing Company, 1 Hudson Street, New York, manufacturer of "Kwik-lite" flashlamps and battery-operated lanterns, has just opened an office and warehouse in the Wells-Fargo Building, San Francisco, Cal. The company has also recently opened offices in Toledo, Ohio, and Windsor, Ontario, Can.

Walter E. Holland has resigned his position as research engineer for the Anderson Electric Car Company, Detroit, to become a firm member of the Broadway Automobile Company of Seattle, Wash., agent in the Northwest for Detroit electric pleasure cars, Walker balance-drive electric trucks, Elwell-Parker industrial trucks, and Philadelphia "Diamond-Grid" storage batteries. Mr. Holland will be secretary and treasurer of the company. Mr. Holland was connected with Thomas A. Edison, Inc., for ten years.

Electrically Driven Boats.—Fredrik Nannestad, manager of the municipal electric-lighting system at Stavanger, Norway, will visit the United States during October to attend the Exposition at San Francisco, and while in this country desires to collect information relating to the use of electricity for the operation of boats. In the harbor of the city of Stavanger are several islands with which ferry communication is contemplated. The round trip will consist of a total travel of about 2500 yards and will take about thirty minutes, including five stops.

Electric-Car Manufacturer Optimistic.—The Anderson Electric Car Company, Detroit, Mich., is expecting the coming year to be one of the best that the electric-car industry has ever experienced. As already noted in the ELECTRICAL WORLD, the company has reduced the prices of its cars from $600 to $725 each, and on account of this reduction expects the range of its sales to widen considerably. Because of the increased possibilities for business, the Anderson company is appointing a number of new dealers in certain desirable territories which have not up to the present time been represented.

Strike at Schenectady Works of General Electric Company.—Labor unrest which has culminated in strikes among manufacturers of munitions during the last few months was extended this week to the Schenectady works of the General Electric Company. Shorter working hours have been demanded by the employees, while some of the labor officials have insisted on closed-shop conditions at the Schenectady plant before the 10,000 strikers return to work. Thirteen crafts are represented in the strike. Several demonstrations by the strikers occurred on Tuesday and Wednesday, but no disorder of any kind has been reported. Prior to the general strike a grievance committee appointed by the employees is reported to have accepted a compromise plan offered by G. E. Emmons, general manager, but this action is said to have displeased the members of the various crafts and the general walkout followed.

Demand for Fault-Locating Apparatus Increasing.—The Lundin Electric & Machine Company, Boston, Mass., reports the sale of five sets of Vahey fault-locating apparatus for central-station distributing systems at Lynn, Springfield, Malden and Brockton, Mass., and at Hartford, Conn. Since the recent descriptions of the equipment published in the ELECTRICAL WORLD inquiries have come in, and a second lot of apparatus is now going through to fill orders orally arranged for and about to be completed. Representatives of large central-station operating syndicates and of hydro-

electric transmission companies have become interested in the possibilities of the equipment and have examined it in service on the Boston Edison system and elsewhere.

The Acme Die-Casting Corporation, Bush Terminal No. 5, Brooklyn, N. Y., which was organized some eight months ago, has met with such success, according to E. N. Wolf, treasurer of the concern, that it has been found necessary to increase its capital from $125,000 to $200,000. The company is engaged in the manufacture of die castings for small motors and various kinds of electrical devices. Mr. Wolf states that the company has been working its plant to full capacity and has been obliged to refuse business. The Acme Die-Casting Corporation has now contracted for more space and will increase its plant so that more work can be taken in. It contemplates doubling the size of its present plant within the next four months.

Westinghouse Lamp Company Opens Milwaukee Plant.—Owing to the general betterment in business conditions, the Westinghouse Lamp Company, 1261 Broadway, New York, has decided to open its Milwaukee plant for the manufacture of incandescent lamps. Large display advertisements have been inserted in the various Milwaukee papers, offering places to 500 girls, who will be employed in the manufacture of half a million lamps a month. The Milwaukee works of the company are at 3100 Center Street and consist of five large buildings, occupying about five acres of ground. Frank Wick, who has been superintendent of the New York plant of the Westinghouse Lamp Company, will assume the management of the Milwaukee works.

Bakelite Insulation for Wireless Apparatus.—Because of its mechanical and dielectric strength and the fact that it is impervious to moisture, oils and dust and is unaffected by change in temperature, bakelite has been adopted by the Wireless Specialty Apparatus Company, Boston, Mass., for insulating material on its radio equipment. Bakelite is especially useful for apparatus employed in the tropics, where the high humidity and extremes of temperature, it is declared, have rendered many other kinds of materials unsatisfactory. The insulating material in the form of "bakelite dielecto" is obtained in sheets from the Continental Fibre Company, Newark, Del., and all parts, such as auxiliary key, receiver, quenched-spark-gap frame, oscillation transformer, etc., are made of it. The Wireless Specialty Apparatus Company recently made a wireless set for the United States Navy Department, which after tests proved quite successful. The insulating parts of this set were made of bakelite.

Frantz-Premier Company Broadening Scope of Its Activities.—The Frantz-Premier Company, Cleveland, Ohio, is about to place on the market a comprehensive line of electrically operated household devices, including washing machines, wringers (which will be sold separately from the washing machines as well as in conjunction therewith), dishwashing machines and an electric fan for household and office use. As noted in the ELECTRICAL WORLD of June 5, the company is building a new plant at Ivanhoe Road and Euclid Avenue, which will provide the company with greatly increased accommodations. The factory, which is nearing completion, will be of four stories and built of concrete. The company expects to move from its present quarters in the Whitney Power Block to the new building about Nov. 1. The new plant will also enable the company to increase the production of its vacuum cleaners which it has been turning out in large numbers, some 75,000 machines having been made, it is reported, during the past year.

The Labor Outlook.—In an address delivered on Sept. 24 before the students of the Northwestern University School of Commerce in Chicago, W. S. Kies, vice-president of the National City Bank of New York, drew attention to the fact that the huge war orders placed in this country and the exaggerated reports of profits spread through the newspapers have encouraged labor to demand its share of these great profits. As a result, he said, hours of work have decreased and wages have gone up. Laborers in other lines, envious of the wages of munition workers, are making similar demands, with the result that gradually but surely wage standards throughout the country are being lifted. If wages increase, cost of production must necessarily increase. Mr. Kies added: "Easy and quick profits are always demoralizing. There are many manufacturing concerns to-day sacrificing permanent and substantial markets for the present quick gains. The public, excited by tales of huge profits, is speculating as never before. A period of inflation is threatened, and it might be well to count the cost in advance. If wages keep on increasing, if speculation becomes rife, if extravagance induced by easy money permeates our national life, we shall, after the war is over, face a great commercial and industrial crisis. Not only the foreign markets which we now have but our domestic markets as well may be in danger. Realizing the competition in store for us, ought we not to begin immediately to prepare for this commercial warfare?"

Holtzer-Cabot Electric Company Moves into New Factory.—The new factory of the Holtzer-Cabot Electric Company on Amory Street, in the Roxbury district of Boston, has just been occupied by the company. The new factory consists of a main building, 300 ft. by 60 ft., six stories high, with an annex 100 ft. by 60 ft., six stories high, and with a subbasement 60 ft. by 60 ft, which is employed as a garage. The boiler house is 42 ft. by 42 ft., 20 ft. high, with a 5-ft. 6-in. chimney, 120 ft. high. The foundry building is 60 ft. by 60 ft. and is one story high The buildings are on a lot containing approximately 250,000 sq. ft. which backs on the shore line of the New York, New Haven & Hartford Railway. The construction is reinforced concrete with brick-paneled walls on the outside and terra-cotta partitions plastered on the inside, and the buildings are fireproof throughout. Energy for operating the plant is obtained from the Edison Electric Illuminating Company. The central-station mains are led into a transformer house, 16 ft. by 24 ft., which is in the yard outside of the main building. Seven large conduits run directly from the transformer house to the south end of the third floor of the building, which is the test room for all electrical apparatus. The mains are connected to a large switchboard, 30 ft. long, specially designed and built by the Holtzer-Cabot company. A complete system of direct-current wiring is also installed and takes care of the telephone and factory signal apparatus. The new plant has enabled the company to consolidate its offices and factories, which were on Albany Street, on Bristol Street and in Brookline, Mass.

Good Demand for Lighting Fixtures.—There is at the present time an excellent demand for lighting fixtures in New York City, according to the Lighting Studios Company, manufacturer of decorative lighting fixtures. Orders are coming in for the equipment of office buildings which were finished in the spring, but where, for different reasons, it was decided to wait until the fall to install the fixtures. Another interesting large source of present orders is the re-equipment of a number of large buildings, both office and apartment. When the buildings were put up no care apparently was taken to install fixtures that were either efficient or artistic. Cheapness and thoughtlessness seem to characterize these installations. The result has been that in the fall when new tenants took the apartments and when the lighting hours began to overlap business hours the tenants demanded better and more efficient equipment. Orders of this nature have been quite frequent of late with the Lighting Studios. When asked as to the effect of the war, it was stated that so far there had been no decrease in the export trade to France, Great Britain or the colonies of the latter country. After the war it is thought that this trade will be larger. One interesting point was brought out, namely, that before the war Germany had supplied this country with a large amount of decorative glassware. Our glass manufacturers, having been forced to it, now find themselves in a position to make the same ware cheaper and better than Germany did previous to the war. The Lighting Studios Company feels that the advances made in this direction will not only cut down the German competition largely after the war but will also considerably strengthen the position of the American glassware and lighting-fixture manufacturers.

Recent Orders for Electrical Equipment.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the following among the orders recently received: The Public Service Electric Company, Newark, N. J., two 1083-kva. air-blast transformers; the Board of Commissioners of State Institutions, Lincoln, Neb., one 200-kw., 240-volt engine-type generator, one 15-kw. turbine-gear-driven exciter, one 20-kw. motor-driven exciter, twelve

transformers with a total rating of 190 kva., four 220-volt, three-phase motors with a total rating of 15 hp., and eight 220-volt, three-phase motors with a total rating of 88.5 hp.; J. G. Robertson, city of Warren, Minn., one 150-kva., 2400-volt, three-phase engine-type generator, one 75-kva., 2400-volt engine-type generator, one 10.75-kw. belted exciter, one 5.5-kw. belted exciter and one four-panel switchboard; the Harrisburg Foundry & Machine Works, for installation in the Home for Colored Persons at Philadelphia, Pa., one 25-kw. direct-current generator with switchboard; the Interurban Construction Company, for the Salt Lake & Utah Railroad Company, three 250-kw., 750-volt direct-current rotary converters for series operation on 1500-volt circuit, three-phase current, and three 150-kva., 44,000-volt, single-phase, sixty-cycle transformers with triple secondaries and complete switching equipment; the Craig Electric Company, for the Schenley High School, Pittsburgh, Pa., two 300-kw., 250-volt (direct-current), sixty-cycle, 1200-r.p.m. self-starting rotary converters with one ten-panel switchboard; the Public Service Electric Company, Newark, N. J., one 1083-kva. air-blast transformer, four 48-kva., single-phase, sixty-cycle, 2400-volt, 10-per-cent-regulation induction regulators, and two 24-kva., 2400-volt, sixty-cycle, single-phase, 10-per-cent-regulation induction regulators; the New York & Queens Electric Light & Power Company, Long Island City, N. Y., two 1500-kva. air-blast transformers, two 1000-kva. air-blast transformers, three 1500-kva. air-blast transformers with dial regulator of the step type, and four 46-kva. induction regulators; the Burlington (Vt.) Traction Company, one 500-kw. rotary converter, three 165-kva. transformers and one two-panel switchboard.

NEW YORK METAL MARKET PRICES

	Sept. 28 Selling Prices Bid	Asked	Oct. 5 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot*	71 0 0		72 2 6	
Prime Lake	17.90	to 18.00	17.87½	to 18.12½
Electrolytic	17.90	to 18.00	17.87½	to 18.12½
Casting	17.00	to 17.25	17.25	to 17.50
Copper wire base	19.25	to 19.50†	19.25	to 19.50†
Lead	4.50		4.50	
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Spelter, spot	14.37½	to 14.02½†	.....	.....
Tin, Straits	33.12½†		32.12½†	
Aluminum, 98 to 99 per cent	48.50†		50.00	to 51.00

*OLD METALS

Heavy copper and wire	15.00†	16.25
Brass, heavy	9.75†	11.00
Brass, light	8.00†	9.25
Lead, heavy	3.75†	4.20
Zinc, scrap	9.50†	10.75

*COPPER EXPORTS

Total tons to Oct. 5	3,556

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Consumers' Electric Company of Maquoketa, Iowa, has been chartered with a capital stock of $50,000 by A. A. Hurst and H. E. Stevens of Maquoketa.

The North Arkansas Utilities Company of Corning, Ark., has been incorporated by G. A. Booser, C. L. Daniel, Elizabeth Morrison and H. B. Hays. The company is capitalized at $75,000 and purposes to contract and operate power plants and railroads.

The West Salem Ice & Light Company of West Salem, Ill., has been incorporated with a capital stock of $15,000 to generate and distribute electricity and to manufacture and sell ice. The incorporators are E. H. Hallbeck, P. O. Hallbeck and W. E. Scheurer.

The Commonwealth Light & Power Company of Iowa Falls, Iowa, has been granted a charter with a capital stock of $250,000 for the purpose of generating and distributing electricity. The officers of the company are: Frank H. Tichenor of Wilmette, Ill., president; Harley L. Clarke of Wilmette, Ill., vice-president; Clifford W. Humphrey of Chicago, Ill., secretary, and Frank H. Tichenor of Wilmette, Ill., treasurer.

New Industrial Companies

The Lancaster Automatic Light & Power Company of Lancaster, Ohio, has been chartered for the purpose of manufacturing small electrically driven light and power plants for farms and other isolated places.

The Sumter Electrical Company of Chicago, Ill., has been incorporated with a capital stock of $5,000 to manufacture and deal in machinery. The incorporators are F. C. Manning, Charles C. Strickland and L. N. McIntosh.

The Talking Electric Sign Company of Minneapolis, Minn., has been chartered with a capital stock of $80,000 by E. Lynn Leach, A. M. Ellert and William B. Krause, Minneapolis, and J. H. S. Gifford, St. Paul, Minn.

Trade Publications

Resistance Metals.—Ellsworth Haring, 114 Liberty Street, New York, has prepared a booklet on resistance metals and nickel sheets, wires, bars, etc.

Wiring Devices.—"Condulet Stock for Electrical Dealer, Contractor and Central Station" is the title of a booklet issued by the Crouse-Hinds Company, Syracuse, N. Y.

Resuscitating Apparatus.—The Life-Saving Devices Company, 180 North Market Street, Chicago, Ill., has published folders which contain information on its "lung-motor."

Ball Bearings.—The Ball Bearing Company, 50 Church Street, New York, has prepared a booklet, entitled "Special S K F Bulletins," which directs attention to the various publications issued by the company.

Flashlamps.—The Usona Manufacturing Company, 1 Hudson Street, New York, has prepared several illustrated folders which contain information on various kinds of flashlamps and battery-operated lanterns.

Vacuum Cleaner and Heating Pad.—The Hotpoint Electric Heating Company, Ontario, Cal., has issued a catalog which contains information on a recently developed vacuum cleaner and flexible-metal heating pad.

Transmission Systems.—Fred T. Ley & Company, Springfield, Mass., have prepared an attractively illustrated catalog which shows various installations of transmission lines, substations and underground systems installed by them.

Cabinets and Switching Apparatus.—The Large-Dail Manufacturing Company, 114 North Thirteenth Street, Philadelphia, Pa., has prepared an illustrated catalog on its steel cabinets and boxes, panelboards, switchboards and special switches.

Small Lighting Plants.—The Suburban Lighting Company, Toledo, Ohio, is sending out illustrated catalogs entitled "Lighting Country Homes" and "Electric Lighting Systems," which contain information on its gasoline-engine-driven generating plants.

Gas Engines.—The Bruce-Macbeth Engine Company, 2122 Center Street N. W., Cleveland, Ohio, has prepared a booklet which contains illustrations of various gas-engine installations, information on producing-gas plants, and miscellaneous gas-engine data for the operator.

Electric Organ Blowers.—The Kinetic Engineering Company, Baltimore Avenue and Sixtieth Street, Philadelphia, Pa., is sending out illustrated catalogs on its electrically operated combined suction machine and blower for operating mechanical orchestras and of its blower for use with church organs.

Lighting Handbook.—The Holophane Works of the General Electric Company, Cleveland, Ohio, have just issued an interesting ninety-four-page handbook on lighting. The book is divided into five sections and contains numerous diagrams and illustrations. Section I deals with "Holophane service" and Section II with the fundamentals of illumination; Section III outlines methods of installing the products of the Holophane works; Section IV deals with practical applications in armories, gymnasiums, banks, bowling alleys, churches, factories, etc., and Section V is on photometric curves. Appendix A contains supplementary engineering data, and Appendix B gives tables on watts per square foot for various classes of service.

Construction News

New England

PEPPERELL, MASS. — Negotiations have been closed whereby the Shirley El. Co., Shirley, will take over the electric distribution system in Pepperell. The company is to erect a high-tension transmission line from its present terminus at the cordage works to Pepperell to supply electricity for commercial and municipal purposes.

GROTON, CONN.—The United States government has awarded the borough of Groton a contract to supply electricity to the naval station, which is to be opened as a submarine base this fall.

Middle Atlantic

BEACON, N. Y.—The City Council has voted to install ornamental lamps on Main and Beekman Streets. The plans provide for the erection of ornamental iron standards mounted with 600-cp. nitrogen lamps, of which eighty will be placed on Main Street and sixteen on Beekman Street. The cost is estimated at $6,000.

BUFFALO, N. Y.—The Buffalo Cold Storage Co., it is reported, is contemplating the construction of a power house, at a cost of about $45,000.

CHATHAM, N. Y.—The Chatham El. Lt., Ht. & Pwr. Co. has been granted a franchise to supply electricity in the town of Austerlitz, and has applied to the Public Service Commission to extend its transmission lines to Morehouse Corners, about half way between Chatham and Spencertown. The lines have already been extended to the town limits of Chatham. The company has offered to extend its lines to Spencerport, which is about 2 miles from Morehouse Corners, provided that sufficient patronage is guaranteed to warrant the expenditure. The company is also considering a proposal to be submitted to the village of Hillsdale which would require the erection of 10 miles of line. A proposal has also been submitted to the residents of the Rock City section, about 3 miles north of Chatham, offering to extend its service there, provided that the property owners and others desiring electricity will furnish and erect the poles.

CORNING, N. Y.—Plans, it is reported, have been prepared for the construction of a large reservoir to utilize the waters of Lake Wayne and Lamoka and a hydroelectric plant on the shores of Lake Keuka to develop 15,000 hp. Electricity generated at the plant will be transmitted to Corning, 24 miles distant, and also to Hammondsport. At a dam to be built on the David Smith farm, 3 miles from Savona, electricity will also be generated for transmission to Savona, Campbell, Bath and other places. All leases have been secured to carry out the project, and it is understood that the capital has been pledged. A company will soon be organized to construct and operate the system. Robert O. Hayt, Corning, is engineer in charge of the work.

EAST SYRACUSE, N. Y.—Plans are being considered by the Board of Trustees and the Syracuse Ltg. Co. for installing a new street-lighting system. It is proposed to replace the present system, which consists of 45 arc lamps and 26 incandescent lamps, with incandescent lamps.

FREDONIA, N. Y.—The Public Service Commission has granted the Niagara & Erie Pwr. Co., Fredonia, permission to extend its transmission lines to the town of Brant and village of Farnham, Erie County, and in the towns of Pomfret and Sheridan, Chautauqua County. Local franchises have been secured in all of the towns.

ITHACA, N. Y.—A committee has been appointed by the Business Men's Association to make investigations relative to the installation of an ornamental lighting system on the principal business streets. Present plans provide for the erection of sixty lamps, to cost from $4,000 to $6,000.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Oct. 18 for installing electric equipment in the Evander Childs High School, East 184th Street and Field Place, the Bronx. Blank forms, plans and specifications may be obtained or seen at the above office.

PARMA, N. Y.—The Hilton El. Lt., Pwr. & Ht. Co., Hilton, has applied to the Public Service Commission for permission to erect an electric distribution system in the town of Parma and for approval of a franchise granted by the town.

SYRACUSE, N. Y.—The Syracuse Ltg. Co. is contemplating the erection of a substation on West Fayette Street for the distribution of Niagara and Salmon River power in Syracuse. The station will be equipped with three motor-generator sets having an aggregate output of 12,000 hp. to convert energy received at 11,000 volts, 25 cycles, to 2300 volts, 60 cycles, and 4000 hp. in transformers, transforming 11,000 volts, 25 cycles, to 2300 volts, 60 cycles. The station will also include apparatus to supply electricity for about 700 street lamps. An addition will also be built to the Solvay substation, which will include a new building equipped with 20,000-hp. transforming apparatus. The plans also provide for a 11,000-volt subway from Solvay to Fulton Street, with a branch leading to the station to be erected in West Fayette Street. The cost of the work is estimated at $500,000. J. C. De Long is president of the company.

TONAWANDA, N. Y.—Plans are being considered for the installation of an ornamental lighting system in the business section. The Tonawanda Pwr. Co., North Tonawanda, has agreed to install three different styles of lamps for demonstration purposes.

BALLY, PA.—Bonds to the amount of $6,000 have been voted for the installation of a municipal electric-light plant in Bally.

CONNELLSVILLE, PA.—Ground has been broken for an addition to the power plant of the West Penn Railways Co. in Connellsville. The equipment will consist of a 19,000-kw. Westinghouse turbo-generator, three large Stirling type boilers equipped with stokers, four large transformers and high-tension switches, etc. Contracts for building and equipment have already been placed. The cost of the plant is estimated at about $1,000,000.

HARRISBURG, PA. — Charters have been granted by the State Department to the Farmers' El. Co. of Warewich Township and the Farmers' El. Co. of Penn Township, both in Lancaster County. Each company is capitalized at $5,000.

HARRISBURG, PA.—The Public Service Commission has approved the following contracts: The Duquesne Lt. Co. of Pittsburgh and the city of Pittsburgh, and the Penn El. Ser. Co. of Somerset and the county of Somerset. Charters have also been approved for the Paint El. Co. of Somerset County and the Scalp Level El. Co. of Cambria County.

MONONGAHELA, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 27 for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Monongahela. Drawings and specifications may be obtained at the above office or from the custodian of site at Monongahela.

MILLVILLE, N. J.—The City Commission has awarded the contract for street lighting to the Millville El. Lt. Co. The contract provides for the installation of new lamps.

VIENNA, N. J.—The Hackettstown El. Lt. Co. has submitted two proposals for lighting the streets of Vienna and Great Meadows. The first is to install the lamps, ten in each place, provided that a 10-year contract is signed. The other is that each town is to install its wires and lamps and the company to supply electricity to maintain them.

SALISBURY, MD.—The Eastern Shore Gas & El. Co. of Delaware, which recently acquired the properties of the Salisbury Lt., Ht. & Pwr. Co. of Salisbury and the Cambridge Gas, El. Lt. & Pwr. Co. of Cambridge, is contemplating improvements and

Completion of Arrowrock Project Using Energy from Boise River Development

BOISE, IDAHO.—The completion of the Arrowrock Dam in the Boise River Canyon, the formal inauguration of which took place in Boise on Oct. 4, will mean the irrigation of 240,000 acres of land in western Idaho. The dam was built with hydroelectric energy developed from the river itself and stands 348.5 ft. high, 90 ft. of which is below the bed of the stream and is anchored to solid granite. The cost of the dam is estimated at $5,000,000. The Boise hydroelectric power plant, which was constructed primarily for supplying energy to build the Arrowrock dam, is at the site of the diversion dam, the point where the water released from the great dam above is diverted into the main canal leading to the lands of the irrigation project 30 and 40 miles below. The power house is of concrete and steel and utilizes a 25-ft. fall. The equipment consists of three Allis-Chalmers 725-hp. hydraulic turbines, each directly connected to a generator. The dam was built in four years (a record in dam construction), and credit for this rapid construction is largely given to the use of electricity, which made possible the employment of three shifts of workmen on the task. The plant also furnished all the electricity for lighting the town of Arrowrock, which sprang up below the dam and had a population of 1500. To one side of the dam a spillway (400 ft. long) has been cut through a cliff of solid granite. On the opposite side of the dam a concrete log chute has been built to permit the passage of logs from the reservoir to the river below. On this same side, should it be deemed advisable to build an additional hydroelectric plant, a tunnel can be bored through the mountain side to tap the reservoir and provide sufficient water to develop 50,000 hp. The plant also supplied electricity to operate the dredges in connection with the building of the drainage ditches.

extensions to its power plant and transmission lines. Day & Zimmerman, 611 Chestnut Street, Philadelphia, Pa., are general managers.

MADISON, W. VA.—The Royal Block Coal Co., it is reported, is asking for bids on mining machinery, to include gravity screen, electrical cutting and hauling equipment, etc.

MINERAL, VA.—The installation of a municipal electric-light plant and waterworks system is reported to be under consideration by the City Council.

WINCHESTER, VA.—The light committee of the Council has been instructed to ask for bids for lighting the city with electricity for a period of five years, from June 1, 1916. The Council is considering the question of establishing a municipal electric-light plant.

WASHINGTON, D. C.—The contract for furnishing and installing the mechanical equipment in the new office building for the Southern Ry. Co. at Pennsylvania Avenue and Thirteenth Street, Washington, has been awarded to Riggs, Distler & Stringer, Baltimore, at $45,000. The contract includes boiler-plant equipment, plumbing, heating and fire protection.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 18,387—A commercial agent informs this bureau that information and prices are desired by a business man in Central America relative to storage batteries suitable for use on tram lines and in the operation of motor boats. Correspondence may be in English. No. 18,451—A commercial agent of the bureau reports that the following articles are urgently needed in the Netherlands: copper brushes for electric motors, copper sheets for the manufacture of printing blocks, steel wire, etc. No. 18,481—An American consular officer in Brazil reports that a firm of civil and electrical engineers has just begun business in his district and desires to be placed in communication with American exporters. The firm desires to make a specialty of the sale of American goods. Correspondence may be in English. No. 18,502—A commercial attaché of the Department of Commerce reports that an American consular agent in Spain has requested the names of firms in the United States able to supply copper tubes, planing, drilling and punching machines, bending rolls, woodworking machines, electric motors and automatic tools. No. 18,551—An American consular officer reports that bids will be received by the Direccion-General de Obras Publicas, Ministerio de Fomento, Madrid, Spain, for the construction of strategic railways, (1) from Estada and Tamarite to Balaguer, (2) from Gibraleon via Paimogo to the Portuguese frontier. Tenders for electric traction will be considered. Bids will be received until Feb. 19, 1916, for No. 1, and until Nov. 20, 1915, for No. 2. No. 18,558—An American consular officer in the United Kingdom reports that a firm in his district desires catalogs and price lists from the manufacturers of brass parts for electric-light accessories. Samples accompany the report and may be examined at the bureau and its branches (refer to file No. 66,372). Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 19, for furnishing at the various navy yards and naval stations supplies as follows: Charleston, S. C., Schedule 8846—one ambulance automobile. Brooklyn, N. Y., Schedule 8832—miscellaneous electric heaters, single-boat type; Schedule 8836—miscellaneous interior-communication cable, 7500 ft. soft-steel, single-conductor wire; Schedule 8833—4300 ft. lighting and power wire, 6000 ft. rubber-covered, single-stranded wire, 1000 ft. rubber-insulated, lead-covered wire. Washington, D. C., Schedule 8844—one outfit for pumping water; Schedule 8847—25 electrically illuminated sextants. Norfolk, Va., Schedule 8845—one storage-battery truck. Bids will also be received until Oct. 26 for the following supplies: Mare Island, Cal., Schedule 8839—six portable ventilating sets. Brooklyn, N. Y., Schedule 8867—160 side lamps for motor boats; Schedule 8869—6300 ft. interior-communication cable, 1500 ft. rubber-insulated, rattail wire, miscellaneous single and twin-conductor wire; Schedule 8871—25 0.25-hp. portable ventilating sets. Boston, Mass., Schedule 8861—one electric blueprinter machine. Philadelphia, Pa., Schedule 8862—miscellaneous interior-communication cable, miscellaneous lighting and power wire. Washington, D. C., Schedule 8857—6650 ft. single-conductor cable, three 125-hp. induction motors. Bids will also be received until Nov. 2 as follows: East and West, Schedule 8854—miscellaneous dry cells; Schedule 8851—miscellaneous sheet and strip gum gaskets. Brooklyn, N. Y., and Mare Island, Cal., Schedule 8851—800 lb. molded rubber gaskets. Mare Island, Cal., Schedule 8841—miscellaneous telegraphs, mechanical engine, transmitters, indicators, etc. Washington, D. C., Schedule 8878—one electric welding outfit; Schedule 8877—three 75-kw. oil-cooled transformers. Puget Sound, Wash., Schedule 8874—7000 steel boiler tubes, miscellaneous rough brass angle and gate valves. Pensacola, Fla., Schedule 8880—one motor delivery wagon. Bids will also be received until Nov. 9 as follows: Mare Island, Cal., Schedule 8865—miscellaneous water-tight annunciators, miscellaneous circuit-breakers, miscellaneous gongs, general alarms, contact makers, etc., one electric whistle outfit, two electric docking telegraphs, miscellaneous thermostats; Schedule 8875—one oxygen compressor. Bids will also be received until Nov. 30 for 25 portable transmitting and receiving radio sets to be delivered at Washington, D. C., as per Schedule 8876. Application for proposals should designate the schedule desired by number.

North Central

BAY CITY, MICH.—The Bay City Pwr. Co. has secured the right-of-way for the erection of an electric transmission line from the city of Bay City to the mines operated by the Robert Gage Coal Co., west of the city.

CLEVELAND, OHIO.—A bond issue of $75,000 to extend the West Side municipal light distributing system has been approved by the Council committee on finance.

CLEVELAND, OHIO. — The Cyclone Woven Wire Fence Co., Cleveland, has secured a site at East Fifty-fifth Street and New York Central Railroad, on which, it is reported, it will erect a power block, to cost about $150,000, one-half of which will be used by the Cyclone company and the other half rented out to small industries.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until Oct. 13 for furnishing and installing conduit and insulation for underground steam mains and returns. Plans, specifications and proposal blank may be obtained of the commissioner of water, 413 Superior Avenue, City Hall.

ELYRIA, OHIO.—The report submitted to the City Council by the Lorain County Engineering Co. estimates the cost of the installation of a municipal electric plant at about $200,000. The H. L. Doherty Co. and the Green line, it is understood, will be asked to submit bids to supply energy to operate the proposed system.

FORT LORAMIE, OHIO.—The Public Service Commission has authorized the Fort Loramie Lt. & Pwr. Co. to issue $4,000 in capital stock and $5,000 in bonds, the proceeds to be used for extensions and improvements to its system.

MARIETTA, OHIO.—The lighting committee of the Chamber of Commerce has submitted a report in which it recommends the purchase of energy from the Kanawha Trac. & El. Co. of Parkersburg, W. Va., for a period of at least five years.

TIFFIN, OHIO.—The Ohio Lt. & Pwr. Co., Tiffin, is planning to extend its service to Greenspring, Bettsville, Old Fort and Maple Grove, villages in the north side of Seneca County.

WEST LAFAYETTE, OHIO. — The Council has awarded the contract for street lighting to the Ohio Ser. Co., Cambridge. The contract calls for 15 lamps of 250 cp., which will replace the gas lamps now in use.

GOSHEN, IND.—The Hawks El. Co., Goshen, has applied to the Indiana Public Service Commission for permission to expend $40,000 for the erection of a third power plant in Goshen.

SEYMOUR, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for construction, including mechanical equipment and approaches, of the United States post office at Seymour. Drawings and specifications may be obtained from the custodian of site at Seymour, Ind., or the above office.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until Oct. 14, for furnishing and installing at the H. N. May plant, Fullerton Avenue and Chicago River, Chicago, the following equipment: Division A—For furnishing four-conductor lead-covered cable; (B) furnishing multiple-conductor, 12,000-volt, lead-covered cable; (C) furnishing and installing mud drums in the boilers at the H. N. May plant; (D) furnishing 250-kva., 12,000-volt station transformers. For details see proposal columns.

FREEPORT, ILL.—The City Council is considering the question of securing an improved street-lighting system upon the expiration of the present contract with the Freeport Ry. & Lt. Co., which will expire in April, 1916.

MOUNT CARMEL, ILL.—The Board of County Commissioners has awarded the contract for lighting the new county infirmary to the Mount Carmel Utility & Service Co. The company will also supply electricity to residents along the line.

ROSEVILLE, ILL.—The Village Board, it is reported, has signed a contract with the Central Illinois Public Service Co. to supply electricity to operate the municipal electric system. The Public Service Co. will secure energy from the plant of the Monmouth Pub. Ser. Co. A transmission line will be erected from Roseville to Monmouth. The board has decided to purchase energy rather than install new equipment in the municipal plant.

HAYWARD, WIS.—The Council, it is reported, is contemplating improvements to the water-works system, including the installation of steam, oil or electrically driven pumps, steel tower and tank, to cost about $10,000.

MERRILL, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for construction, including mechanical equipment and approaches, of the United States post office at Merrill. Drawings and specifications may be obtained at the above office or of the custodian of site at Merrill.

NEENAH, WIS.—Arrangements have been made whereby all electric and telephone wires in the business section will be removed.

BERTHA, MINN.—The Bottenmiller Co., it is reported, has been granted a franchise to install and operate an electric-lighting plant in Bertha.

BUTTERFIELD, MINN.—Bonds to the amount of $8,000 have been voted for the installation of an electric-lighting system. It is proposed to erect a transmission line to connect with the transmission system of the Consumers' Pwr. Co. at St. James.

KINNEY, MINN.—The Great Northern Pwr. Co., Duluth, has secured a contract to supply electricity to the Helmer mines.

PERHAM, MINN.—Bids will be received by George M. Young, village recorder, Perham, until Oct. 15 for furnishing and installing a new boiler at the municipal electric-light plant.

PIPESTONE, MINN.—The Northwest Lt. & Pwr. Co. of Pipestone will build an addition, 23 ft. by 39 ft., to its power house to provide space for the installation of a 225-hp. Busch-Sulzer Diesel oil engine, a 200-kva., 2300-volt, 60-cycle General Electric generator and switchboard. Equipment has already been purchased and will be installed at once. The company is now installing single-unit ornamental lamp-posts on four blocks. Six ornamental lamp standards will be erected in the near future. Carl I. Oppen is manager.

WEST CONCORD, MINN.—The Village Council has granted the Commonwealth Pwr. Co., Mankato, a franchise to install and operate an electric-light system in West Concord.

AMES, IOWA.—Improvements are contemplated to the local system of the Iowa Tel. Co., including switchboard and underground conduits, to cost about $25,000.

DES MOINES, IOWA.—The City Council has decided to submit to the voters the proposal to grant the Des Moines El. Co. a franchise to install a heating system in the business district at a special election to be held Nov. 15.

FORT DODGE, IOWA.—Plans are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for construction of a dam in the Des Moines River, in connection with the installation of a hydroelectric power plant for the city of Fort Dodge.

LEE'S SUMMIT, MO.—Plans, it is reported, have been prepared by Henrici, Kent & Lowry, consulting engineers, Reserve Bank Building, Kansas City, for the construction of a water-works system at Lee's Summit, to cost about $45,000. It is proposed to install electrically driven pumps.

SLATER, MO.—Bids will be received by the city of Slater, addressed to J. A. Stern, city clerk, until Oct. 20 for furnishing and installing a 250-kva., three-phase, 60-cycle, 2300-volt alternator with exciter, directly connected to a 300-hp. engine. For details see proposal columns.

EDMORE, N. D.—The Edmore El. Lt. & Pwr. Co. has awarded the contract for construction of an electric-light plant in Edmore to the McGuire El. Co., Grand Forks, N. D.

WILLISTON, N. D.—The movement to supply electricity from the electric plant of the federal irrigation project near Williston for a number of towns and villages along the Great Northern Railroad, east of here, including Ray, the prime mover in the proposal, has the support of the village of Epping, which will accept such service if the project is carried through. It is proposed to erect a high-tension transmission line to supply the service. From ten to fifteen towns will be interested in the proposition.

EMERY, S. D.—The Commercial Club has adopted a resolution granting Kit Laing, Bridgewater, a franchise to furnish electricity in Emery for a period of ten years.

BLAIR, NEB.—Bids will be received by S. W. Chambers, village clerk, until Oct. 15 for the construction of a municipal electric-light plant. The Martz Engineering Co., First National Bank Building, Lincoln, has charge of the engineering work.

DUBOIS, NEB.—At an election held recently an issue of electric-light bonds to the amount of $7,000 was authorized.

BUCKLIN, KAN.—Extensions and improvements (including a steam-heating plant) are contemplated to the municipal electric-light plant.

FORD, KAN.—The new Commercial Club is reported to be considering the question of establishing a municipal electric-light plant and water-works system.

KANSAS CITY, KAN.—City improvement bonds to the amount of $124,000 have been sold by the City Commissioners, of which the proceeds of $60,000 will be expended on the municipal electric-light plant, completing plans already made and being carried out. No more equipment, it is understood, will be purchased at present.

LOUISVILLE, KAN.—The contract for the construction of the municipal electric-light plant has been awarded to the Fegan company.

WICHITA, KAN.—The Kansas Gas & El. Co., Wichita, is contemplating extending its service to Buhler and Inman. If it is decided to extend the line, the extension will be made from Burrton.

Southern States

AYDEN, N. C.—The City Council has awarded the contract for the construction of an electric-light plant, for which bonds to the amount of $15,000 were recently voted, to the J. B. McCrary Co., Atlanta, Ga.

LENOIR, N. C.—The Citizens' Lt. & Pwr. Co., Lenoir, it is reported, is contemplating the construction of a hydroelectric plant at Poovey Shoals.

ORANGEBURG, S. C.—The City Council has authorized James E. Salley, city electrician, to prepare plans for extensions to the municipal electric-light plant and water-works system, to cost approximately $50,000.

CUMBERLAND SPRINGS (P. O. TULLAHOMA), GA.—The Cumberland Springs Co., it is reported, is planning to install an electric-lighting plant.

SUMMIT, GA.—Bonds to the amount of $5,000 have been voted for the installation of an electric-light plant in Summit.

WACO, GA.—Plans have been prepared by Boyd W. Little, Bowdon, it is reported, for the installation of an electric distribution system in Waco, to cost about $2,000. Electricity will be obtained from Bremer, two miles distant.

BOLIVAR, TENN.—The electric-light plant, engine house, laundry, ice plant and storehouse at the Western Tennessee Hospital for the Insane, recently damaged by fire, will be rebuilt.

BIRMINGHAM, ALA.—The City Commission has authorized Julian Kendrick, city engineer, to ask for bids for an additional engine and generator for the North Birmingham municipal electric-light plant. The cost of the proposed improvements is estimated at $11,000, and they will double the output of the plant.

GADSDEN, ALA.—The installation of a municipal electric-light plant has been recommended by Mayor W. G. Bellenger to the City Council.

CARRIERE, MISS.—The electric plant of the Lacey Lumber Co., Carriere, was destroyed by fire on Sept. 22. The town at present is without electrical service. Steps will be taken at once to rebuild the plant.

GREENVILLE, MISS. — Arrangements are being made by the Chamber of Commerce and business men for the installation of an ornamental lighting system from the Valley railroad station on Washington Street to Walnut Street and thence to the Southern railroad station.

STUTTGART, ARK.—An improvement has been organized by the city of Stuttgart with a view of acquiring the electric-light plant and water-works system.

TUCKERMAN, ARK.—Steps have been taken, it is reported, for the organization of a company to install and operate an electric-lighting plant in Tuckerman.

NEW ORLEANS, LA.—Bids will be received by Commissioners of Port, New Orleans, until Oct. 13, for furnishing and installing one 100-kw. and one 200-kw. motor-generator set, equipment for series circuit and switchboard for cotton warehouses and terminal on the Mississippi River. Plans and specifications are on file at the office of Ford, Bacon & Davis, 921 Canal Street, New Orleans. Ernest M. Loeb is president of commission.

GOLTRY, OKLA.—An election will soon be called to submit to the voters the proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant in Goltry.

LAHOMA, OKLA.—The installation of a municipal electric-light plant in Lahoma is under consideration.

BROWNSVILLE, TEX.—The Council is considering the extension of the ornamental street-lighting system, at a cost of $4,500.

MEXIA, TEX.—The Central Texas Ice Co. of Mexia has filed amendments to its charter changing its name to the Central Texas Ice, Lt., Pwr. & Wtr. Co. and increasing its capital stock from $60,000 to $120,000.

NEW BRAUNFELS, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 5 for the construction, including mechanical equipment (except lighting fixtures and approaches), of the United States post office at New Braunfels, Tex. Drawings and specifications may be obtained at the above office or from the custodian of site at New Braunfels.

SAN ANGELO, TEX.—The Council is contemplating installing electric lamps on the new concrete viaduct and on Chadbourne Street.

WHARTON, TEX.—The Texas Southern El. Co., Victoria, is reported to have purchased the electric plant of the Wharton Ice & Pwr. Co. and will make improvements to it.

Pacific States

BELLINGHAM, WASH. — The City Council has passed unanimously over the veto of Mayor De Mattis an ordinance calling for tungsten street lamps to replace the arc lamps in use. The installation, which will cover the entire city, will be made by the Puget Sound Trac., Lt., & Pwr. Co.

CENTRALIA, WASH.—The City Commission has granted H. G. Fleischhauer, Portland, Ore., who was recently granted a franchise to supply electricity in Centralia, an extension of 60 days to complete arrangements to furnish electrical service in the city.

OLYMPIA, WASH.—Ne Page, McKenny & Co., Armour Building, Seattle, have been awarded contracts for electrical installations at the Institute for Feeble-Minded at Medical Lake and the School for the Blind at Vancouver, Wash., for $2,983 and $1,285 respectively.

SEATTLE, WASH.—Bids will be received by the Board of Public Works until Oct. 15 for furnishing the City Lighting Department with approximately 292,350 incandescent lamps for the ensuing year. Specifications are on file at Room 115, City Hall. L. B. Young is chairman of board.

WENATCHEE, WASH.—The Dryden station of the Wenatchee Valley Gas & El. Co. was damaged by fire on Sept. 24, causing a loss of between $5,000 and $6,000. The residence and street-lighting circuits in Wenatchee, Waterville and Cashmere will be out of commission until the plant is repaired. The business and water-works circuits will be in service.

PORTLAND, ORE.—Commissioner Baker will recommend to the budget committee of the City Commission this year the lighting of two or three of the city parks, particularly Holladay and Sellwood Parks.

FALL RIVER MILLS, CAL.—The California Pwr. & Mfg. Co., San Francisco, has begun work on the construction of a new power plant in Fall River Mills to supply electricity for irrigation purposes (mainly) and for lamps and motors throughout the entire valley. The water of both Fall and Pitt Rivers will be utilized. M. P. Holmes, San Francisco, construction engineer, will have charge of the work.

LOS ANGELES, CAL.—The city of Los Angeles has posted notices announcing the control of the waters of Rush and Leevining Creeks in the Owens River Valley as additional power sites for the city.

ORANGE, CAL.—The city of Orange is considering the question of establishing a municipal electric-light plant. A committee has been appointed to make investigations as to costs, etc.

QUINCY, CAL.—The Board of Supervisors has granted the Great Western Pwr. Co., San Francisco, a franchise to construct and operate electric transmission lines over the streets and highways in the county of Plumas.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. has applied to the Public Service Commission for authority to issue $13,000 in bonds, the proceeds to be used for extensions to its system in Santa Barbara.

FISH HAVEN, IDAHO.—The Public Service Commission has granted the Swann Creek El. Co. permission to extend its transmission lines into the town of St. Charles. The company now operates in Garden City and Laketown, Utah, and Fish Haven, Idaho.

KELLOGG, IDAHO.—The Washington Wtr. Pwr. Co., Spokane, it is reported, has decided to erect electric transmission lines to the Highland-Surprise mine property on Pine Creek, near Kellogg, to supply energy to operate the mine and stamp mill.

KENDRICK, IDAHO.—Application has been made to the Public Utilities Commission by A. V. Dunkle, Wallace, for permission to construct and operate an electric-light plant in Kendrick. The cost of the plant is estimated at $8,000.

SHELLEY, IDAHO.—The City Council is reported to be considering the installation of an electric-lighting system.

FLORENCE, ARIZ.—Surveys are now being made for the erection of a transmission line from Sacaton to the State prison and to Florence. Arrangements will be made with the Salt River Valley Water Users' Association to obtain electricity for the prison and the city of Florence. The State is to build the line, and the city of Florence will enter into a joint contract with the State for energy.

ANACONDA, MONT.—The City Council has passed a resolution creating special improvement district No. 70 for the purpose of installing ornamental street lamps. The cost of the installation is estimated at $5,000, and bids will, it is understood, soon be asked.

GLASGOW, MONT.—Bids will be received by H. D. Palmer, city clerk, until Oct. 13 for furnishing either a 225-hp. or a 240-hp. oil engine, air compressor, oil tank, etc.; also a 200-kw. generator, belted exciter, switchboard, etc.

MONTE VISTA, COL.—Preparations, it is reported, are being made by the Monte Vista Lt., Ht. & Pwr. Co. for improvements to its system.

PLATTEVILLE, COL.—The Arapahoe El. Lt. & Pwr. Co., Littleton, it is reported, is planning to erect a substation (44,000 volts) in Platteville, to cost about $60,000. O. F. Nars, Littleton, is superintendent.

Canada

CALGARY, ALTA.—Preparations, it is reported, are being made by the Alberta Hydro-Electric Pwr. Co. to build a power plant. A. Fawkes is consulting engineer.

CHESLEY, ONT.—A by-law is under consideration to appropriate $9,000 for the purchase of portions of the local electric-light plant, owned by M. A. Halliday, and $13,500 to provide for the erection of an electric plant and system to transmit and distribute energy to be supplied by the Hydro-Electric Power Commission of Ontario.

RIDGETON, ONT.—Plans are being considered for the erection of a hydroelectric power station, to cost about $10,000.

SARNIA, ONT.—The City Council has voted to submit to the ratepayers hydro-electric by-laws which provide for an issue of $175,000 in debentures for the purchase of the electric plant of the Sarnia Gas & El. Co. Later on a proposal to use hydro-electric power will be submitted to the ratepayers.

TORONTO, ONT.—The Toronto Hydro-Electric Commission is planning to erect a substation at the corner of Gerrard Street and Carlaw Avenue to cost about $60,000. Transformers and other equipment, it is understood, will be required.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 28, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,154,600. Damper-Controlling Apparatus; D. Belden, Auburn, N. Y. App. filed March 28, 1914. Thermostatically controlled motor using ordinary lighting current.

1,154,601. Extraction, Purification and Electrolytic Precipitation of Metallic Zinc from Smelter Fumes, Zinc Ores and the Like; O. Best, San Francisco, Cal. App. filed Sept. 16, 1911. Proceeds first chemically and then electrolytically.

1,154,604. Electroplating Device; H. R. Boissier, Great Neck, N. Y. App. filed June 1, 1914. For plating curtain rods and the like.

1,154,615. Safety Lamp; H. Csanyi, New York, N. Y. App. filed Dec. 9, 1914. Opens circuit upon breaking of bulb.

1,154,626. Terminal for Electric Apparatus; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Aug. 4, 1914. For flat heater units.

1,154,628. Wireless Selective System and Apparatus; J. H. Hammond, Jr., Gloucester, Mass. App. filed Feb. 23, 1910. Sending station controls wave-length of impulses receivable at receiving station.

1,154,660. Plating Machine; L. Schulte, Chicago, Ill. App. filed July 23, 1913. Specially constructed carrier for rods, etc.

1,154,678. Transit Device; N. Whichello and H. Sawyer, Muskegon, Mich. App. filed Sept. 29, 1913. Bridging device connects track rail of crane with an associated track rail.

1,154,700. Telephone Apparatus; A. J. Kempien, St. Paul, Minn. App. filed March 6, 1909. Prevents unauthorized use of telephone.

1,154,701. Process of Producing Tungsten Filaments; E. A. Kruger, Seehausen, Altmark, Germany. App. filed Aug. 25, 1913. Uses mixture of powdered tungsten, carbon and boracic acid.

1,154,725. Regulator; G. R. Radley, Milwaukee, Wis. App. filed Dec. 18, 1911. Particularly for maintaining a constant vacuum in vacuum cleaners.

1,154,728. Rheostat; T. Rhodus, Chicago, Ill. App. filed Dec. 26, 1914. Resistance coil concentrically disposed about shaft carrying a sliding contact member.

1,154,733. Circuit Controller; A. Simon, Milwaukee, Wis. App. filed Nov. 27, 1911. For polyphase circuits; protects its own windings and those of the translating device.

1,154,750. Amplifying Electrical Impulses; R. A. Fessenden, Brant Rock, Mass. App. filed March 11, 1911. Particularly for cable signals.

1,154,759. Trolley-Pole Base; C. E. Gierding, Mansfield, Ohio. App. filed March 2, 1914. Improved clamp for base of trolley pole.

1,154,773. Junction Box; S. A. Huntington, Syracuse, N. Y. App. filed Feb. 18, 1913. Busbars in line with entrance openings.

1,154,784. Metallic Structure and Process of Making the Same; M. Lachman, New York, N. Y. App. filed Dec. 17, 1914. Grille or fence structure welded at intersection of bars.

1,154,791. Mechanical Releasing Means for Electric Brakes; G. M. Marr, New York, N. Y. App. filed Feb. 26, 1914. Mechanical means releases operative pressure of the armature.

1,154,800. Process of Forming Double Nitrides; S. Peacock, Chicago, Ill. App. filed May, 1913. Fixation of atmospheric nitrogen.

1,154,808. Method of Joining Metal by Welded Rivets; A. F. Rietzel, Charlestown, R. I. App. filed Sept. 16, 1909. Rivets welded in holes in the parts connected.

1,154,820. Light-Regulating Device for Film-Printing Machines; G. White, Jersey City, N. J. App. filed June 6, 1914. Automatically regulates the light for successive scenes.

1,154,823. Pot-Head Connector; P. F. Williams, Chicago, Ill. App. filed Oct. 9, 1907. For connecting cables with overhead wires.

1,154,828. Sleet Cutter for Trolley Wires; A. H. Ahrens, Canandaigua, N. Y. App. filed May 3, 1915. Operates in both directions; readily attachable.

1,154,834. Attaching Plug; H. P. Ball, Pittsfield, Mass. App. filed July 19, 1910. Rugged construction for use with heaters.

1,154,849. Means for Controlling Electric Current; C. R. England, McKeesport, Pa. App. filed May 26, 1915. For dimming automobile lamps.

1,154,852. System of Current Distribution; C. Le G. Fortescue, Pittsburgh, Pa. App. filed June 21, 1912. Transformer regulators for maintaining rectified current uniform.

1,154,866. Potential Transformer; O. W. Lunnon and E. Harvey, Denver, Col. App. filed Jan. 27, 1913. Has bent supplemental core strips.

1,154,903. Bonding Device for Rails; A. A. Ziegler, Boston, Mass. App. filed June 23, 1913. Bond loops are supported in exposed condition.

1,154,929. Signaling System; O. M. Leich and C. E. Hague, Rochester, N. Y. App. filed Feb. 17, 1905 System of automatic selectors.

1,154,933. Electrically Welded Tubing and Process of Making the Same; K. Peiseler, Preussen, Germany. App. filed Oct. 24, 1914. Avoids the necessity for removing the burr formed inside the pipe.

1,154,934. Sphygmomanometer; C. J. Pilling, Lansdowne, Pa., and G. S. White, Los Angeles, Cal. App. filed Jan. 9, 1915. Accurately recorded blood pressures.

1,154,945. Automatic Electric Regulator; E. B. H. Tower, Jr., Milwaukee, Wis. App. filed April 10, 1912. Variable-pressure resistance or relay.

1,154,953. Electrical Heating Device; E. L. Wiegand, Youngstown, Ohio. App. filed Sept. 24, 1914. Sadiron construction.

1,154,954. Electric Range; R. Williams, Bogota, N. J. App. filed Oct. 1, 1912. Insures that maximum possible demand shall not exceed two-thirds of the total current rating of the range.

1,154,956. Electric Train-Control System; E. Woltmann, New York, N. Y. App. filed Feb. 19, 1909. Cuts out sections of the third-rail or trolley.

1,154,963. Separable Attachment Plug; R. B. Benjamin, Chicago, Ill. App. filed Nov. 21, 1908. Interlocking effected by rotation of one member on the other.

1,154,976. Controller for Electric Motors; H. H. Cutler, Milwaukee, Wis. App. filed Feb. 10, 1902. Automatic control of variable resistance in motor circuit.

1,154,979. Electrical Measuring Instrument; A. L. R. Ellis, Lynn, Mass. App. filed Oct. 1, 1914. Improved counter balance for the moving element.

1,154,983. Machine Efficiency Recorder; H. R. Ford, Buffalo, N. Y. App. filed Nov. 27, 1914. Records output per hour.

1,154,992. Apparatus for Electrically Igniting Miners' Safety Lamps; V. E. Joyce, London, Eng. App. filed July 24, 1914. Hand-driven generator operable only when connected to lamp.

1,155,000. Art of Glass Manufacturing; O. A. Mygatt, Paris, France. App. filed Nov. 1, 1910. Color-blending effects.

1,155,001. Apparatus for Regulating the Field Density of Electric Generators; G. S. Neeley, St. Louis, Mo. App. filed Aug. 15, 1910. Electromagnets move regulating arm.

1,155,021. Electric-Meter Brush; R. S. White, Washington, D. C. App. filed July 26, 1913. Brushes move longitudinally with the spindle and commutator.

1,155,026. Signaling Device for Vehicles; W. D. C. Wright, Philadelphia, Pa. App. filed July 29, 1914. Solenoids operate pointer through segmental gear.

1,155,036. Electrotherapeutic Apparatus; S. Brooks, Jr., and C. R. Anderson, Los Angeles, Cal. App. filed June 9, 1913. Applies interrupted current simultaneously with direct current.

1,155,046. Storage Battery; W. A. Crowdus, Chicago, Ill. App. filed March 7, 1914. Ribs which confine the active material form projections for spacing the grids.

1,155,047. Storage Battery; W. A. Crowdus, Chicago, Ill. App. filed March 7, 1914. "Solid electrolyte"; selected ground wood.

1,155,058. Electrical Resistance; C. E. Hay, Illford, England, and H. W. Sullivan, London, England. App. filed Sept. 1, 1914. Compact and non-reactive; for wireless work.

1,155,063. Pigtail Brush; J. Hetherington, Newark, N. J., and C. E. Chapin, New York, N. Y. App. filed Jan. 17, 1911. Locked connection, but can be unfastened by screwdriver.

1,155,095. Electrical Measuring Instrument; W. E. Porter, Lynn, Mass. App. filed Sept. 25, 1914. Counterbalance for moving element.

1,155,098. Electrically Operated Water Heater for Automobile Radiators; E. M. Rosenbluth, Philadelphia, Pa. App. filed Jan. 2, 1915. Readily connectible to a radiator and to a lighting circuit.

1,155,100. Portable Electric Flashlight; C. J. Sagebrecht, Brooklyn, N. Y. App. filed Jan. 22, 1914. Improved battery-casing construction.

1,155,106. Synchronizing Recorder; E. O. Schweitzer, Chicago, Ill. App. filed Aug. 12, 1911. Has a continuous record strip which can be advanced after each operation of the synchronism device.

1,155,121. Switch; V. G. Apple, Dayton, Ohio. App. filed Oct. 26, 1914. Quick make-and-break pedal switch for self-starters.

1,155,124. Submarine Signaling Apparatus; C. Berger, New York, N. Y. App. filed Feb. 18, 1913. Rapidly transmits Morse signals.

1,155,133 and 1,155,134. Protective Means for Electrical System; F. Conrad, Swissvale, Pa. App. filed Oct. 31, 1910. For disconnecting injured transmission circuit.

1,155,144. Burglar Alarm; H. T. Gay, Baltimore, Md. App. filed Jan. 29, 1914. Alarm device insertible into valuable box.

1,155,157. Reversing Switch; H. A. Lewis, Norristown, Pa. App. filed May 22, 1911. Has a reversible laminated brush.

1,155,164. System and Method of Control for Electric Motors; L. G. Riley, Wilkinsburg, Pa. App. filed Oct. 3, 1913. Particularly for motors operated from a storage battery.

1,155,166. Percolator; E. E. Rose, Pittsburgh, Pa. App. filed Dec. 5, 1910. Removable heater applicable to ordinary alcohol burner percolator.

1,155,167. Electric Heating Apparatus; E. E. Rose, Swissvale, Pa. App. filed Feb. 19, 1914. Thin, flat "bayonet" heater.

1,155,170. System and Method of Control for Electric Motors; N. W. Storer, Pittsburgh, Pa. App. filed Oct. 5, 1912. Secures a series of regenerative braking speeds.

1,155,197. System of Electric Motor Control; H. L. Beach, Edgwood Park, Pa. App. filed April 12, 1912. For planers, etc.; periodically adjusts motor speed.

1,155,208. Electrically Lighted Pencil; W. Q. Browne, Boston, Mass. App. filed Oct. 19, 1914. Portable lamp with pencil clamped thereto.

1,155,225. Electric Locomotive; G. M. Eaton, Wilkinsburg, Pa. App. filed Feb. 21, 1911. Articulated trucks; avoids use of king pin.

1,155,226. Trolley Wheel; E. E. Eby, Wilkinsburg, Pa. App. filed Jan. 7, 1914. Current flows from wheel to its shaft through conducting fluid.

1,155,249. Flashlight; H. M. Koretzky, New York, N. Y. App. filed Jan. 29, 1915. In the form of a watch.

1,155,290. Starting Box; M. Taigman, New York, N. Y. App. filed July 6, 1914. Disconnects current supply when retracting spring breaks.

1,155,291. Starting Box; M. Taigman, New York, N. Y. App. filed July 13, 1914. Locks starting lever when retracting means breaks.

1,155,301. Key-Controlled Contact Maker for Use with Musical Instruments; J. W. Darley, Jr., Baltimore, Md. App. filed Oct. 15, 1912. Particularly applicable to organs.

1,155,302. Circuit-Closer; J. W. Darley, Jr., Baltimore, Md. App. filed July 3, 1908. Inertia-controlled means operated by a key to close circuit.

1,155,307. Switch-Operating Device; D. D. Gordon, Chicago, Ill. App. filed Feb. 12, 1914. Pull chain does not enter switch shell.

1,155,322. Electric-Circuit Timing Device; R. C. Leake, Rochester, N. Y. App. filed April 17, 1915. For drum carrying peripheral circuits.

13,989 (reissue). Selective System of Telephony; R. C. M. Hastings, Columbus, Ohio. App. filed May 8, 1915 (original patent No. 1,061,285, May 13, 1913). Exchange operator answers subscriber and operates selective means.